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Friend Or Foe: The Effect Of Shared Group Status On Aggressiveness And Testosterone In Response To Provocation

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FRIEND OR FOE: THE EFFECT OF SHARED GROUP STATUS ON AGGRESSIVENESS AND TESTOSTERONE IN RESPONSE TO PROVOCATION

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DEDICATION

This dissertation is dedicated to Ryan and Shelly Colgan, Michael Califano, James Geeting, and David Russo.

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CHAPTER 1

Introduction

Like other animal species, humans have the ability to recognize kin through a variety of social and physical cues. These cues, which signify the degree of relatedness between an individual and another person, will also predict types of behavior directed toward other individuals. Research has generally found that individuals identify with others that share phenotypic qualities, such as skin color or facial features, in a favorable manner as predicted by Hamilton's (1964) theory of inclusive fitness. An extension of this work would also include members of shared social groups as kin. The current thesis will investigate the impact of shared group status and its influence on aggressive behavior during a decision-making game. It is expected that individuals who play with a member of a shared social ingroup will respond less aggressively (in comparison to a social outgroup) in a decision-making game that is designed to provoke aggressive responses from players. Moreover, it is expected that changes in testosterone, a hormone linked to individual differences in aggressive response to competition, will be influenced by the group status of the other player in ways similar to the results of previous research on interpersonal competition.

The Process of Social Categorization

Individuals, by nature or by coincidence, are members of a wide variety of groups that are often perceived to be collective and possess some sort of common thread. For example, individuals can be grouped together by their preferred sports team, place of birth or residence, skin color, alma mater, religion, or birth month. Group status can be more or less salient at different times. For example, although two individuals can

differentiate themselves on their specific political ideologies at the national level (e.g. Democratic vs. Republican), they may both commonly identify with the same country of origin in regard to world-level politics (e.g. United States vs. Russia). The process of social categorization appears to be a necessary underlying mechanism to understand interpersonal interactions between members of various social groups. Without perceiving and categorizing individuals into one group or another, the application of group-based stereotypes, attitudes, and behaviors based on group membership would not be possible. The process of social categorization simplifies a vast amount of social information for individuals and allows them to arrange it into a reference guide. This reference guide allows for more efficient processing of person-perception information, the creation of expectations for the future, and informs the perceiver of to-be accessed attitudes, beliefs, and behaviors when interacting either physically or vicariously with a group member (Macrae & Bodenhausen, 2000, 2001). Further research on the social categorization process suggests it to be automatic (Devine, 1989), yet it may be consciously controlled under specific conditions (Gilbert & Hixon, 1991). Some characteristics appear to be dominant in person-perception, such as age (Brewer & Lui, 1989), race (Blair, Judd, & Fallman, 2004; Hewstone, Hantzi, & Johnson, 1991), and gender (Brewer & Lui, 1989; Martin & Macrae, 2007), Quinn and Macrae (2005) have shown that not all categorical possibilities are applied at the time of exposure to an individual. Thus, it would appear that some characteristics are favored over others barring specific motivation.

Although categorization may serve to efficiently sort information into an understandable format, it also appears to promote intergroup biases. Various lines of

research have studied the detrimental effects of existing social group memberships and the consequence for individuals as both perceivers and targets. Although numerous real-world examples of prejudice and discrimination exist (e.g. increased prejudice toward immigrants from the Middle East in America following the attacks of September 11th, 2001), there are also multiple factors that may account for variability in these attitudes and behaviors, such as political ideology, cultural expectations, or personal contact with immigrants. Experimental evidence appears to be consistent with explanations focused on the impact of differences in social categories. For example, Bagby and Rector (1992) found that when individuals were asked to rate the guilt of a defendant from a social outgroup in a simulated rape trial, the degree to which the defendant was rated as guilty was higher if the rape victim was from their ingroup than an outgroup. Analyses of real and mock jury outcomes also suggest a racial bias when Black defendants are judged by White jurors when they are not explicitly instructed to suppress racial biases (Sommers & Ellsworth, 2000; 2001). Avenanti, Sirigu, and Aglioti (2010) present evidence suggesting that there is a lack of empathy (i.e. experiencing others' emotions / feelings) when individuals were observing physical pain in cross-race others. Greenwald, McGhee, and Schwartz (1998) identified evaluative biases using an implicit association test, in which White participants associated more negative than positive evaluations with Black targets and more positive than negative evaluations with White targets. Even when an evaluated outgroup is a fictional creation with an unknown history and lacking in pre-determined evaluations and associations, American individuals appeared to more positively evaluate Americans than members of the fictional outgroup using similar methodology (Ashburn-Nardo, Voils, & Monteith, 2001).

It is important to realize that cultural expectations, personal experience, and social learning play a large role in determining intergroup biases. Thus, it is plausible that it is not the categories themselves that perpetuate biases, but rather the environmental factors that appear to co-vary with differences in group membership. Other lines of research, however, have suggested that group membership alone can often act as a sufficient predictor of bias. Research using the minimal group paradigm, wherein participants are assigned or exposed to experimentally-created group memberships, has shown to create prejudice and discrimination. Tajfel (1970; Tajfel, Billig, Bundy, & Flament, 1971) showed that when children were led to believe that they had specific "estimation styles" and were then asked to allocate resources between two other hypothetical children who either shared their "style" (ingroup) or did not (outgroup), the children displayed preferential treatment to the ingroup member over the outgroup member. Billig and Tajfel (1973) found similar results of preferential treatment to ingroup members even when the participants were explicitly informed that their group membership was determined at random. Hertel and Kerr (2001) replicated these findings and found that priming group loyalty resulted in increased ingroup favoritism.

Hartstone and Augoustinos (1995) found that when individuals were more likely to show ingroup favoritism when there were only two groups considered (i.e. "us" vs. "them") than when there were three groups. The authors suggest that dichotomizing individuals into one group or another may invoke a sense of direct competition. Findings by Tajfel (1970) suggest a similar interpretation, as analyses of the group allocation suggest that the children were likely to use a strategy for maximizing group differences (i.e. overall less to my group, but even less to your group) than for maximizing group

payoff (i.e. overall more for your group, but slightly more for my group). Though it would seem possible that perceiving competition between groups would lead to group-based discrimination and favoritism, would competition motives also lead to associations of the outgroup with negative evaluations given that prior exposure or possibilities for attitude creating were non-existent? Ashburn-Nardo et al. (2001, expt. 3) found that when individuals were dichotomized into a minimal group, they showed stronger associations between positive evaluations and ingroup members and negative evaluations and outgroup members. These results are similar to those previously found in existing social groups (Greenwald et al., 1998).

Although individuals in modern society may still retain biological markers (e.g. skin color), grouping by genetically produced traits may not allow for adequate precision for the purpose of identifying or recognizing separate and distinctive group boundaries and their respective members. Van den Berghe (1981) suggested that multiple types of badges and markers may be used, ranging from phenotypic traits (e.g. skin pigmentation, hair color), man-made markers (e.g. tattoos, piercings, bodily mutilations), and behavioral markers (e.g. speech, accent, rituals, mannerisms). Arguably, the use of specific markers may facilitate not only identification of individuals and their respective "group" but also indicate which individuals should be trusted and approached or distrusted and avoided. Some markers are more likely to be trusted as accurate indicators of group membership than others due to the difficulty in faking them. For example, it may be easy to fake a cultural norm, but more difficult to fake a skin color or an accent. Given that individuals should be likely to help those perceived to be similar to them (Hamilton, 1964) it would be advantageous for genetically related individuals to

share a common badge to guide the recognition process leading to altruistic behaviors. Kurzban and Christner (2010) further this notion by suggesting that permanent markings, body disfiguration, and other types of irreversible “badges” may be used as a commitment tool by groups to maintain loyalty of its individuals. By marking oneself as a member of one group, an individual will be largely unable to be move freely amongst other groups. Kurzban and Christner (2010) suggest that signaling beliefs in public may be a modern equivalent of ritualistic markings; claiming a particular belief system in public may be a way to show commitment to the ingroup by reducing the likelihood of acceptance in other groups.

In presuming adaptive benefits for identifying individuals based on badge or marker recognition, Kurzban, Tooby, and Cosmides (2001) suggest that humans developed over time cognitive mechanisms to detect “coalitional alliances” when encountering strangers. These mechanisms, although potentially useful for accurately identifying one’s sex and age (characteristics important for identifying potential outcomes and interactions), are not suggested to have evolved for the purpose of classifying individuals based on their racial characteristics, or skin color. The authors argue that the likelihood to be exposed to members of distinct races would have been so low as to not favor the evolution of a race-based categorizing mechanism. Instead, they suggest that quickly and accurately identifying potential coalitions and alliances shared among individuals would have been an adaptation. Thus it is suggested that racial characteristics may satisfy this mechanism’s input criteria. Furthermore, the authors suggest that such a mechanism would be sensitive to two factors: one of which would track common actions and goals of among individuals and one to be vigilant in

identifying potential markers of group identification. Given that such a mechanism might perform well by identifying common traits or appearance and coalitions, relatively arbitrary (but shared) characteristics may be interpreted as signs of allegiance. As a consequence, race is only useful to the degree that it predicts group categorization for the purpose of coalition identification.

Based on this prediction, Kurzban and colleagues (2001) constructed a study that attempted to reduce the usefulness of race as a predictor of group membership and instead focus that attention and vigilance on other coalition-suggesting cues. A memory-recall protocol developed by Taylor, Fiske, Etcoff, and Ruderman (1978) has previously been used to assess the degree to which individuals categorize others into groups by indexing intergroup biases in impression formation and attributions. After being shown a series of paired statements and pictures of the supposed speaker, participants are given a surprise recall task. Typical results of this protocol show that individuals, when asked to recall who said what, will more often confuse the speaker of the statement with other members of the speaker's group (ingroup) than with members not of the speaker's group (outgroup). Kurzban and colleagues (2001), hypothesizing that these allegiance mechanisms operate by identifying common actions and goals, had participants read over statements made that could be inferred to be an argument between two rival teams. The teams were equally comprised of White and Black males. Thus, the only true predictor of group was the statement spoken. Their first study showed that although the verbal statements did produce a pattern of within-group memory biases, race-based memory biases were found to be twice as strong. In a second study, the speakers were given group-based colored shirts (gray or yellow), providing a shared appearance. The

second study's outcomes suggested that even when race-based characteristics were present, the shirt color (visually salient, but not explicitly emphasized) produced two and a half times the bias as race.

Resources, Reciprocation, and Positive Attitudes

Given that research would suggest that humans exhibit the ability to not only categorize others into specific groups based on a variety of cues but also recognize those that have been previously categorized, further analyses of *why* this ability developed are essential. Evolutionary psychology suggests that showing preference for one's ingroup would be favorable for obtaining and retaining resources and other advantageous outcomes (e.g. help and protection). This favoritism would not only be conducive to passing on one's own genes (as a result of increased resources) but also the genes of other members of the ingroup, with whom individuals share genetic similarities (Brewer, 1999; Fishbein, 1996). Expanding on this assertion, Brewer (1999) argues that prejudice does not necessarily come from a desire to derogate other groups and should be considered independently of favoring one's ingroup. Furthermore, ingroup favoritism is a result of sociality among human beings as a survival strategy. "Obligatory interdependence" among human beings, such as living with others for the purpose of sharing information, aid, and resources would have likely been more adaptive than living alone. Conversely, outgroup members are perceived to have the capacity to reduce the fitness of the individual through non-reciprocation of resource sharing and other benefits (Trivers, 1971), but also to actively compete for the same resources as members of the ingroup. Brewer (1999) ultimately suggests that outgroup

discrimination is not necessarily a conscious drive to aggress onto others, but a consequence of ingroup favoritism and preferential treatment.

On the topic of trust of others, especially contrasting between ingroup and outgroup members, Brewer (1999) suggests that individuals will selectively choose to benefit specific others when a cost to oneself is incurred. This cooperative strategy is designed to reduce the possibility of non-reciprocation, wherein an individual must weigh the costs and benefits of sacrificing one's own resources for another. Although it may be beneficial for all if individuals living in a social environment provide help to others indiscriminately and expect likewise in return, individuals must consider the possibility that reciprocation may or may not happen. Brewer (1999) argues one purpose of forming social groups is to limit the possibility of non-reciprocation and to foster interdependence among a collection of individuals; whereas blind trust of others to reciprocate shared resources has the possibility of being abused, mutual trust among ingroup members promotes a sense of general cooperation and an increased likelihood of reciprocation.

Trivers' (1971) elaborated on a model of reciprocal altruism, wherein altruism is defined "… as behavior that benefits another organism, not closely related, while being apparently detrimental to the organism performing the behavior…" Trivers' model asserts that altruism evolved as a result of altruistic individuals receiving more benefits than costs over time, especially when engaged in multiple interactions with a relatively limited set of individuals in an environment in which reciprocation is both possible and expected. In addition to other group-related behaviors and safeguards that would help ensure appropriate reciprocation, Trivers (1971) offers that expectations of positive (i.e.

reciprocal) behaviors between individuals will further foster positive attitudes toward ingroup members. Brewer (1999) and Neuberg and Cottrell (2008) also suggest that positive outcomes stem from expecting reciprocated behavior and that these attitudes are integral in the development of prejudice, or more specifically, ingroup preference. Similarly, Trivers (1971) also suggested that those who “cheat”, or do not appropriately reciprocate (if at all) would likely be sanctioned or ousted from the group and the monitoring behaviors at the individual and group level would be relevant to maintaining mutual cooperation within a single group. In contrast, individuals may come to expect non-reciprocation, or cheating, from outgroup members and may have avoided interacting or assisting these others as a result. Genetic Similarity Theory (Rushton, 2005) suggests that altruism is a function of ethnocentrism as a result of members of ethnic groups being more genetically related to each other than a randomly selected other. This knowledge of ingroup kinship may foster cultural norms of xenophobia as to protect the ingroup (and its members) from expending resources on non-group members.

Intergroup Aggression and Harm Avoidance

Although the arguments for the evolutionary basis of intergroup biases thus far have been focused on the benefits of ingroup favoritism for the individual, outgroup disfavor and discrimination also have a place in the evolution of intergroup biases. In describing the development of prejudice in children as a combination of evolutionary, sociocultural values, and a cycle of development, Fishbein (1996) discussed intergroup hostility in both non-human primate and humans, focusing on data indicating that groups are often hostile toward rival groups to gain and control additional resources.

Additionally, groups are likely to react aggressively to the outgroup to protect their own resources, women, and children from pillage. Just as individuals may form a coalition to share and provide aid to each other, groups also form for the purpose of collective defense and offense. Evolution would have favored those who worked with others to collect and defend resources and not those attempting to survive on their own.

Tinbergen (1968) addressed the apparent disposition of humans to attack one another more fiercely than any other species. Although Tinbergen briefly discusses the usage of threatening cues, fear, and provocation in a variety of species, he stresses the importance of group territories and the adaptations that have evolved to flourish in this living arrangement. He states, “As a social, hunting primate, man must originally have been organized on the principle of group territories” (p. 1414) and further suggests that it is this tendency to divide into smaller units based on common traits or characteristics that promotes aggression toward one another (likely to be found in intergroup conflict). Similar to Kurzban et al (2001), Tinbergen suggests that cultural evolution has far outpaced human genetic evolution and that humans are “… a misfit in his own society” (p. 1415). Offensive collective aggression is suggested to be adaptive as it would have increased the fitness of the individual by increasing access to territory, resources, and reproductive opportunities in addition to reducing potential competition for vital resources via increased mortality rates of outgroup members. Realistic Group Conflict (LeVine & Campbell, 1972) suggests intergroup prejudice and discrimination is a result of real-world conflict to control valuable resources (e.g. money, land, jobs). As finite resources start to become less available to a group and its individual members, groups may act aggressively toward other groups perceived (accurately or not) to be competing

for those resources (see Esses, Dovidio, Jackson, & Armstrong, 2001, for a review). For example, as unemployment rates go up, anti-immigration attitudes may also rise if immigrants are perceived as taking away potential jobs and economic resources. Jackson and Esses (2000) showed that when individuals considered themselves in economic competition with immigrants, they were less likely to support "empowerment" assistance, or policies that would further equal economic opportunities across social groups. Jackson and Esses (2000) also showed that those more likely to endorse social hierarchies (compared to social equality) were less likely to endorse assistance that would empower immigrants, especially when those individuals believed that resource allocation exists as a zero-sum game, wherein a gain for an outgroup is a loss for the ingroup.

The tendency to desire and endorse social hierarchies and group inequalities, or social dominance orientation (Sidanius & Pratto, 1999, see Sidanius & Pratto, 2011, for a review) has been suggested to be a strong predictor of intergroup prejudice. Not only does social dominance orientation predict negative attitudes against outgroups, it also predicts intergroup behaviors. Kteily, Sidanius, and Levin (2011) discuss longitudinal data suggesting that social dominance orientation is a causal predictor (not just a "mere reflection") of both negative attitudes toward outgroups and friendship preference (i.e. proportion of friends who were ethnic ingroup vs. outgroup members). Status inequality between groups is also an important factor for understanding intergroup biases. Bettencourt, Dorr, Charlton, and Hume (2001) conducted a meta-analysis, which suggested that high-status groups generally showed more intergroup bias (ingroup favoritism, higher ingroup evaluation, and outgroup discrimination) than low-status

groups. It may be beneficial for high status groups be more discriminatory toward low status groups, especially when trying to maintain a social hierarchy that favors one's group. Groups that are able to maintain their high status position may be more likely to benefit from social inequality while groups lower in status may try to promote equality for all groups. The status of group power, size, and resources has been suggested to play a large role in determining varying emotional responses (e.g. fear, anger, pity, envy, disgust) in individuals in response to outgroup member or actions perceived to be collectively taken by an outgroup, which affect subsequent behaviors (Cottrell & Neuberg, 2005).

Hormone Influence on Interpersonal Interactions

General research on interpersonal interactions and how they are influenced by social categorization processes suggests that these processes act as a means of regulating behavior between ingroup and outgroup others and that these processes are sensitive to the social context in which social categorization occurs. Additionally, these types of behavioral tendencies (e.g., helping others, acting cooperatively, withholding aid, acting aggressively) also appear to be influenced by changes in hormones as a reaction to the immediate environment. These approaches to human behavior focus on the impact of affective and cognitive processes that lead to specific behavior patterns, but also on the physiological and neurological states that influence these outcomes.

Oxytocin, a neuropeptide that is primarily responsible for milk ejection and parturition (Soloff, Alexandrova, & Fernstrom, 1979), has also been implicated in increased interpersonal trust (Baumgartner, Heinrichs, Vonlanthen, Fischbacher, & Fehr, 2008; Kosfeld, Heinrichs, Zak, Fischbacher, & Fehr, 2005) and increased social

attachment and bonding (Feldman, Weller, Zagoory-Sharon, & Levine, 2007; Young & Wang, 2004). Oxytocin has been identified in the development and maintenance of the bond between parents and their children (Gordon, Zagoory-Sharon, Leckman, & Feldman, 2010). Oxytocin has also been linked to other social behaviors not directly related to attachment and pair bonding (for reviews, see Campbell, 2010; Lee, Macbeth, Pagani, & Young, 2009. Work by Rimmele, Hediger, Heinrichs, and Klaver (2009) found that participants had increased recall ability for a series of previously seen faces following administration of oxytocin, but this improvement in recall was not found for other stimuli (e.g. art sculptures, landscapes). These authors suggest that oxytocin is strongly related to enhancing social interactions through increased encoding of facial cues, facilitating positive interpersonal interactions in a highly social environment. Work by Baumgartner and colleagues (2008) found that participants who were administered oxytocin were more trusting of the other players in a financial decision-making game following a betrayal than were participants administered a placebo. These authors interpret their findings to suggest that oxytocin is related to reductions in fear of others.

Oxytocin also appears to influence interpersonal and intergroup behavior as a result of similar or dissimilar group status. Across several experiments De Dreu, Greer, Van Kleef, Shalvi, and Handgraaf (2005) have found that artificially induced increases in oxytocin levels in males led to an increase in ethnocentric attitudes and behaviors. In particular, increased oxytocin levels were influential on ingroup favoritism rather than discrimination aimed at the outgroup, suggesting that the influence of oxytocin on affiliative behaviors is sensitive to the social context in which these behaviors occur (see also Bartz, Zaki, Bolger, & Ochsner, 2011; De Dreu, Greer, Handgraaf, Shalvi, Van

Kleef, Baas and colleagues, 2010). De Dreu (2012) suggests that this tendency to express ingroup favoritism following the administration of oxytocin is reflective of an increased motivation to protect and assist members of the ingroup for the purpose of enhancing group power and status relative to relevant outgroups. Since not all interpersonal interactions are equal with respect to costs, benefits, and future possibilities of altruistic reciprocation (see Trivers, 1971), it would be most efficient to direct these altruistic behaviors specifically toward ingroup members and away from outgroup members. This context-dependent influence of oxytocin on behaviors suggests a complex interaction of social context, specific environmental cues, and an individual's biological state.

Another hormone, testosterone, has been identified as an important influence in interpersonal and intergroup behavior and has been related to human aggression and competition (Archer, 1991; Mazur, 1985). Testosterone is an androgenic steroid hormone produced primarily in the Leydig cells of the testes in males, but also in the adrenal cortex and the ovaries of females and is responsible for the development of male sexual organs and of male secondary sex characteristics such as bone mass and muscle growth. Testosterone production is regulated by the hypothalamic-pituitary-gonadal axis. The hypothalamus releases gonadotropin-releasing hormone (GnRH), which acts to promote the release of luteinizing hormone from the anterior pituitary gland and which stimulates the testis to create and release testosterone. This same system can also inhibit the production of testosterone through inhibition of GnRH production, which reduces luteinizing hormones leading to a reduction in testosterone synthesis. Testosterone circulates via plasma and is generally bound to one of two

proteins, sex hormone-binding globulin (SHBG) and albumins. Testosterone that is not bound is free to circulate and can bind with intracellular androgen receptors in brain areas (e.g., medial amygdale, hypothalamus) that have been linked to aggressive behavior (Nelson & Chiavegatto, 2001).

Testosterone has been identified as a hormone related to human aggression and competition (Archer, 1991; Mazur, 1985). Meta-analyses conducted on the relationship between baseline testosterone levels and aggression (r = .08; Archer, Graham-Kevan, & Davies, 2005) have found small positive correlations (Archer et al., 2005). This relationship, however, is stronger when assessing change in testosterone in response to a threatening situation or interpersonal provocation (Archer, 2006; see also Carré & McCormick, 2008; Carré, Putnam, & McCormick, 2009; Carré, Gilchrist, Morrissey, & McCormick, 2010). Testosterone is also influential in the long-term development of physical characteristics (Hansen, Bangsbo, Twisk, & Klausen, 1999; Siiteri & Wilson, 1974) that may pre-dispose an individual to favor aggressive behavioral patterns (Archer, 2005; Collaer & Hines, 1995), further suggesting that testosterone is indirectly related to aggression via preference for status- and dominance-promoting behaviors (Archer, 2006, Mazur & Booth, 1998; Rowe, Maughan, Worthman, Costello, & Angold, 2004).

Biosocial Model of Status

Mazur's (1985) Biosocial Model of Status elaborated on the influence of testosterone in human and non-human social interactions with a specific focus on social status and displays of interpersonal dominance. Mazur (1985) argued that the emergence of complex social hierarchies in human and non-human primates' social

environments led to the development of methods by which individual members can determine status, rank, and dominance within their society (e.g. language, reputation, lineage, physical stature) and that changes in testosterone were related to these displays of dominance (particularly in males). Although Mazur (1985) argued that dominance-related behaviors are influenced by testosterone, this relationship need not include the use of aggressive behavior, though it was expected if aggression could be used as a means of asserting dominance. The relationship between testosterone and dominance-related behaviors is suggested to be reciprocal; changes in testosterone levels may promote or inhibit attempts to assert interpersonal dominance whereas changes in status through dominance may increase or decrease testosterone levels. This interaction between testosterone and behavior would suggest that individuals who succeed in asserting their dominance (and experience an increase in testosterone) are likely to engage in future behavior that would maintain their heightened status while individuals who have a loss in status (and experience a decrease in testosterone) are likely to inhibit dominance-related status-seeking behaviors.

Mazur (1985) suggested that these changes in testosterone and behavior during interpersonal interactions involving displays of dominance operated in a manner akin to situational discomfort, wherein individuals attempt to induce stress or anxiety in others with the goal of eliciting deferential behavior. Dominance competitions can determine interpersonal status ranks based on the behavioral response of the actors; the winners are those who “overstress” their opponent, resulting in an increase of deferential behavior by the loser toward the winner. Mazur (1985) suggests this would result in the winner experiencing an increase in testosterone and in the loser a decrease in

testosterone. These differences in testosterone changes would then further predict behaviors for both the winner (increased dominant behaviors) and the loser (increased deferential behaviors). Importantly, individuals with decreased testosterone levels engaged in a within-group status competition may experience increased stress levels when engaging in competition with other group members. This stress can be alleviated through the display of deferential behaviors, which signal submission to an opponent. These behaviors, though likely causing a decrease in status within the group, may be conducive to maintaining social order and cohesion through the avoidance of direct conflict with other group members (Flinn, Ponzi, & Muehlenbein, 2012; Wagner, Flinn, & England 2002).

Previous research has found that individuals with higher levels of testosterone are more likely to behave in an aggressive or risky manner in comparison to those with low levels of testosterone in a number of situations, including the use of illegal substances (Dabbs & Morris, 1990), violent criminal behavior (Dabbs, Carr, Frady, & Riad, 1995), response to aggressive provocations (Olweus, Mattson, Schalling, & Löw, 1988), and risky encounters (Apicella, Dreber, Campbell, Gray, Hoffman, & Little, 2008; Burnham, 2007).Experimental manipulations of testosterone levels have also been shown to influence the extent to which individuals act in an aggressive and risky manner in interpersonal interactions. Zak, Kurzban, Ahmadi, Swerdloff, Park, Efremidze, and colleagues (2009) found that the offers made by men toward their partner in the ultimatum game were more selfish when experiencing artificially increased testosterone levels in comparison to the offers made by the same individuals at baseline testosterone levels. Additionally, increased testosterone levels were related to a tendency to reject

offers (i.e., to punish the partner for selfish behavior) at a higher rate than the same individuals at baseline testosterone levels. These findings stand in comparison to work by Zak, Stanton, and Ahmadi (2007), which found that an artificial increase in oxytocin levels was related to making more generous offers in the ultimatum game. The findings by Zak and colleagues (2009) suggest that increased testosterone levels are related to behaviors that seek to maintain or achieve dominance over others, but also to punish others for acting in a dominant manner at the risk of self-harm (e.g., rejecting a selfish monetary offer).

To examine the relationship between testosterone and aggression, Pope, Kouri, and Hudson (2000, see also Kouri, Lukas, Pope, & Oliva, 1995) found that men with artificially heightened levels of testosterone acted more aggressively toward a fictional opponent. Male participants were provided with testosterone and placebo injections over a period of several weeks and provided behavioral measurements of aggression using the Point Subtraction Aggression Paradigm (PSAP; Cherek, 1981). This task is explained to participants as a game in which they play against a (fictional) opponent by pressing two buttons to earn points which correspond to a monetary reward after the experiment is over. Pressing button A 100 consecutive times would reward the participant with a point (non-aggression) while pressing button B 10 times will take away a point from the opponent (aggression). The participants were provided with a financial motivation to obtain as many points as possible as the total points accumulated at the end of the study were traded in for $0.50 each. The experimenters provoked the participants to respond aggressively by having the opponent (in reality a computer-controlled program) take a point away from the participant at consistent intervals. Those

participants who had been recently administered testosterone were more aggressive (i.e., chose to take away a point from their opponents) than when the same participants had been measured at baseline or after placebo administrations.

The path through which testosterone is related to aggressive behavior and social dominance includes any number of complex social situations encountered both in human ancestral and modern history. Using non-human animal data Wingfield, Hegner, Dufty, and Ball (1990) put forth the *challenge hypothesis* to explain increases in testosterone during mating periods as a result of mate-obtaining and mate-retention concerns, which further predict increases in aggressive and dominance-related behaviors aimed at improving reproductive success (e.g., mate guarding, territory protection, status- and dominance-specific behaviors). Several predictions from a modified model of the challenge hypothesis have been applied to and found to be adequate in describing several facets of human aggression (Archer, 2006). Specific to the current thesis, the challenge hypothesis predicts that males are likely to experience increases in testosterone levels in response to competitive challenges from other males, especially when a challenge has the potential to confer a positive status upon the victor. Several studies have found that anticipating and participating in a competitive task leads to an increase in testosterone levels in a variety of domains, such as athletic and intellectual competitions (Mazur & Lamb, 1980; Mazur, Booth, & Dabbs, 1992),

Although competitive tasks generally lead to increases in testosterone, the outcome (i.e. winning vs. losing) of the competitive task is related to differences in testosterone increases (Mazur, 1985). Archer (2006) compiled findings from a series of male-focused studies involving naturalistic sports competitions and laboratory-based

tasks and found that winners experienced bigger changes in testosterone levels than losers. In addition to skill-based competitions and their outcomes, luck-based outcomes also appear to moderate testosterone changes. McCaul, Glaude, and Joppa (1992) reported that male students across two studies reported more positive moods and bigger testosterone increases after winning in a competition that involved outcomes (as perceived by the participants) determined by random chance by use of coin flipping. These authors found that mood differences partially mediated the relationship between task outcome (i.e., winning or losing) and changes in testosterone levels and further suggested that these mood differences help to reinforce the production of testosterone following success over time. Mazur (1985; see also Mazur & Booth, 1998) suggests that increases in testosterone serve to regulate future behavior for the purpose of maintaining high status through continued competitive success, which would likely lead to increased positive attitudes, similar to the findings reported by McCaul and colleagues (1992).

Vicarious experiences of competition have also been shown to influence changes in testosterone levels. Berhardt, Dabbs, Fielden, and Lutter (1998) found that male fans of winning teams and losing teams experienced increases and decreases, respectively, in testosterone. Although many of the outcome-based findings in competition have focused on the impact of sports teams, political affiliations appear to be sufficient for eliciting similar changes. Stanton, Beehner, Saini, Kuhn, and LaBar (2009) showed that male voters who cast a ballot for Barack Obama, the winner of the 2008 US Presidential election, had an increase in testosterone shortly after the election results were declared whereas male voters who voted for John McCain had a decrease in testosterone. In a

similar finding, Carré and Putnam (2010) found that recalls of previous competitive outcomes were also related to changes in testosterone levels. When asked to watch a video of a previous victory, college hockey players experienced an increase in testosterone in comparison to watching a previous loss (study 1) or a neutral video (study 2). These changes in testosterone following immediate and past experiences of success and failure suggest that the perception of status through intergroup competition can also elicit behaviors seeking to maintain or achieve status in the future (see also Mazur, 1985).

The social context in which competition occurs has been found to be a determining factor of testosterone change and expressed aggression toward opponents. Wagner and colleagues (2002) studied competition in a group setting by having pairs of men from a Dominica village compete in games of dominos against other pairs of familiar men from the same village or unfamiliar men from a different village. Comparing overall post-game testosterone levels, it was found that the pairs playing against unfamiliar others had a higher level of testosterone than pairs playing against familiar others. The authors note that despite several methodological issues with their study, including a relatively small sample size and the lack of rigid experimental control, this difference in testosterone levels based on the competition's social context is suggestive of a coalitional strategy aimed at maintaining intragroup relationships. In comparison to previous research showing that testosterone rises in response to competitive situations (Archer, 2006; Wingfield et al., 1990) and a positive relationship with social status and dominance (Ehrenkranz, Bliss, & Sheard, 1974; Schaal, Tremblay, Soussignan, & Susman, 1996; Van Bokhoven et al., 2006), Wagner and colleagues suggest that an

increase in dominating others (via aggressive behavior) in within-group competition may lead to overall negative outcomes for maintaining a strong coalition with others. They reason that if a group strives to maintain equal status amongst its members, any attempt by one individual to exert dominance over another ingroup member may be met with rebuke and other penalties, such as physical violence or social isolation. In contrast, increased dominance-related motivations may be beneficial when directed toward other groups and these motivations may regulate aggressive status-enhancing behaviors toward outgroup members (see Mazur, 1985).

A similar outcome was found by Oxford, Ponzi, and Geary (2010) using violent video games. Male participants were divided into groups and practiced playing a team-based competitive game for several weeks. Following the practice period, participants played the game against their own teammates or against other teams as a group. It was generally found that between-group competitions resulted in an increase in testosterone levels, especially when victorious, in comparison to the within-group competitions. The authors concluded these outcomes were in contrast to the predictions of the challenge hypothesis (Archer, 2006; Wingfield et al., 1990) and suggested that the difference in testosterone change was related to coalition maintenance. In comparison to Wagner and colleagues' (2002) study in which the men playing dominos were familiar with their within-group teammates and opponents, the participants playing the video games were not familiar with each other outside of the laboratory setting. This situational difference suggests that long-term familiarity with others (e.g., teammates or opponents) is not a necessary factor of testosterone change.

Flinn and colleagues (2012) expand on this argument in their review of hormonal influence on aggression specifically related to human coalitions. These authors review research related to human coalitional psychology with a specific focus on the benefits of sociality. In addition to various other hormonal influences, Flinn and colleagues (2012) highlight the impact of testosterone on one-on-one competitive interactions and suggest that testosterone is a vital component for these events by affecting physical and mental abilities necessary for winning competitions. In analyzing a sample comprising of data from the study by Wagner and colleagues (2002) and additional unpublished data, Flinn and colleagues (2012) further hypothesize that changes in testosterone are directly related to the ability of humans to maintain coalitional ties. Similar to general findings reported by Oxford and colleagues (2010), male competitors playing dominos had an increase in testosterone following a win and a decrease in testosterone following a loss against an outgroup member, but showed no changes in testosterone when playing against ingroup members regardless of the outcome. Flinn and colleagues (2012) suggest that these findings, specifically the differences in testosterone change due to the competition suggest that the need to maintain coalitional ties may further regulate the expression of dominance-related behaviors.

These data on testosterone, aggression, and social context seem at odds with the arguments put forth by Mazur (1985; see also Mazur & Booth, 1998), that individuals possessing or seeking social power or resources will be likely to engage in dominance-related behaviors for maintaining or achieving that status. Flinn and colleagues (2012) suggests that although individuals may develop a general strategy to seek status and interact with others through dominance-related behaviors, the social

context in which that behavior would take place (e.g., coalition cues present in the environment) is likely to regulate its expression. The regulation of these behaviors would further maintain an advantage for individuals through social connections and group cohesion. Thus, although individuals in a group may immediately benefit from aggressively competing against their ingroup members for status and resources, the possibility of negative long-term outcomes (e.g., being excluded or stigmatized) may prompt individuals to reduce aggressiveness toward ingroup members but not toward outgroup members.

Rationale and Hypotheses

Research based on social categorization processes suggests that individuals are pre-disposed to express favoritism and positive attitudes towards those that share group status. Although much of the research has identified increased positive attitudes and behavior toward others resulting from shared group status (i.e., cooperation), there is a lack of research showing the purposeful reduction or suppression of aggressive behavior (i.e., conflict) toward these similar others. For example, individuals may react differently to aggressive behaviors from ingroup members and may choose to act less aggressively toward these others as compared to outgroup members. Additionally, it's possible that any resulting behavioral differences would be accompanied by changes in related physiological and neurological mechanisms.

Separate lines of research concerning competition suggest that individuals are likely to aggress against opponents in competitive tasks and this aggression is related to changes in testosterone levels (e.g., Carré & McCormick, 2008). Work on coalition-specific behavior suggests that these aggressive responses and changes in testosterone are not consistent and appear to be influenced by the immediate social

context of the competitive task (e.g., ingroup vs. outgroup opponents; Flinn et al., 2012). The insights derived from these research lines suggest that a cue of shared group status be implemented in determining the optimal level of aggression against a competitive opponent (e.g., Oxford et al., 2010).

Based on the reviewed research, it is hypothesized that when individuals play a game in which another person acts aggressively toward them, individuals will respond aggressively as well as experience an increase in testosterone throughout the task and that participants' aggression and changes in testosterone will be systematically related. It is also hypothesized that these aggressive reactions and increases in testosterone will occur to a greater degree when the aggressor is a member of a social outgroup as compared to a social ingroup member. Furthermore, it is predicted that changes in testosterone during the competitive task will be most strongly correlated with aggressive behavior when interacting with an outgroup vs. ingroup member. Finally, it is also hypothesized that individuals who play a game involving competition with an ingroup member will report less general satisfaction with the game, as compared to playing with an outgroup member.

Chapter 2

Method

Participants

A total of 65 male participants (M_{age} = 20.83, *SD* = 4.26) were recruited from the Wayne State University research participation pool. Participants were instructed to refrain from eating and brushing their teeth for at least two hours prior to the study to minimize interference with salivary assays. Data from two participants were removed due to a failure to follow study instructions leaving a total of 63 participants, of which 41 self-identified as Caucasian and 22 self-identified as African-American.

Materials and Procedure

All experimental sessions were conducted by the same male experimenter. Participants were led into the laboratory and asked to read over the study information form which included information informing them they would be playing a game with another player. Participants were informed that another participant was in another laboratory on campus and they would be playing the game in real-time with each other and that they would be seeing each other's face during the game. After providing consent, participants posed for a facial photograph. Although the pictures were not actually used for the purposes of the study, they served to create a believable cover story. Immediately after the photograph participants were asked to provide the first of four saliva samples. The saliva samples were collected through passive drool into polystyrene culture tubes which were frozen and placed into a storage freezer at (-20*C) until assayed.

Following the photograph and first saliva sample, participants were asked to complete an online 60-item personality questionnaire on a computer workstation. The

questionnaire included 10 items from each of five personality traits (fairness, aggressiveness, cooperativeness, dominance, and self-esteem), which were obtained from the International Personality Item Pool (Goldberg et al., 2006), as well as a 10-item short-form of the Big Five Inventory (Rammstedt & John, 2007). Participants were presented with each statement and asked to provide their agreement with the statement using a 7-pt response scale with anchors of “not at all like me” and “just like me”. The full list of questionnaire items can be found in Appendix A. These data were collected to assess potential differences that may have explained any possible differences in behavior in the upcoming task. For example, previous research has found positive relationships between baseline testosterone and trait dominance and this relationship was predictive of future aggression (Carré et al., 2009; see also Johnson, Burk, & Kirkpatrick, 2007). In addition to measuring dominance, the task used in the current study involved possible tit-for-tat strategies involving reactive aggression so it was possible that differences in traits such as fairness and cooperativeness might be predictive of task behavior regardless of experimental condition. Although these traits were not directly related to the current study’s hypotheses, it did allow for experimental comparisons for both experimental control and exploratory analyses.

Participants were then provided instructions for the Point Subtraction Aggression Paradigm (Cherek, 1981), which served as a behavioral measure of aggression. In the PSAP, participants are told they will be playing a game with another player and that they will be provided with three decision options with the ultimate goal of obtaining as many points for themselves as possible. Participants were also told they had the opportunity to win up to $10 at the end of the study and that this reward would be

determined by the amount of points obtained during the game. In the PSAP participants could choose from three available options, buttons 1, 2, and 3. Pressing button 1 100 consecutive times would reward the participant with one point, while pressing button 2 10 consecutive times would "steal" a point from the other player, which had the effect of reducing the other player's point total by one. All participants were informed that they were randomly assigned to an additional condition in which they would not be able to keep the points they "stole" from the other player, but the other player would be able to keep the points stolen from the participant. By removing the practical incentive for participants to repeatedly steal points from the other player (i.e. to more easily obtain points) participants are motivated to choose pressing button 1 to gain points for themselves. As a result, any choice to steal a point from the other player can be inferred as an act of aggression rather than an effective game playing strategy. Pressing button 3 10 consecutive times would "protect" the participant's points from being stolen for a period of 45 seconds. Once participants chose one of the three options, it was necessary to complete the required number of presses before choosing another option.

Participants were randomly assigned to the "ingroup" (n = 32, of which 21 were Caucasian) or "outgroup" (n = 31, of which 21 were Caucasian) condition, in which they were shown a facial photograph of a male from their ethnic ingroup or outgroup (i.e. White or Black target face) during the PSAP as the other player throughout the duration of the PSAP (see Figure 1). To control for differences in behavior resulting from potential differences in the target faces, a separate sample of participants (N = 41) rated 45 White male and 29 Black male faces using a 7-pt scale for perceived aggressiveness, trustworthiness, and attractiveness. Two faces were selected that were

similar in ratings and close to the midpoint on all three traits. The mean trait ratings for the White target were 3.93, 4.34, and 4.05, respectively. The mean trait ratings for the Black target were 4.02, 4.07, and 2.88, respectively.

Although participants were led to believe they would be playing with this other participant, the other "player's" behavior was controlled by an automated script. The script was programmed to provoke the participant by initially stealing a point 45 seconds after the round began and again every 6 to 60 seconds after the first stolen point. Participants were first given a 1-minute practice trial to familiarize themselves with the PSAP. After completing the practice trial, participants started the first of three 7-minute rounds of the PSAP and provided a saliva sample after the conclusion of each round. During all three rounds of the PSAP, the experimenter left the room to provide privacy for the participant and to reduce the likelihood of participants modifying their behavior to meet any perceived expectations by the experimenter.

After completing the three rounds of the PSAP and providing the last saliva sample, participants were asked to complete a post-PSAP questionnaire regarding their perceptions and general attitude toward the PSAP as well as provide demographic information. The post-PSAP questionnaire and demographic form can be found in Appendices B and C, respectively. Upon completion, participants were debriefed and thanked for their participation. Regardless of their performance during the PSAP, all participants were rewarded with $10. A general timeline of the experiment may be found in figure 2.

Chapter 3

Results

Data Preparation and Preliminary Analyses

Questionnaire data.

Personality scores were created by summing and averaging across the trait-specific items from the personality questionnaire after reverse-scoring as necessary. Independent sample t-tests were conducted on all ten scale scores between the experimental conditions to examine possible pre-existing differences in the characteristics of the participants. As can be seen in Table 1, none of the comparisons were statistically significant. As a result of these data, and that the assessment of the personality traits was only for exploratory purposes, these traits were not further analyzed.

Saliva samples.

Due to sample spill seven saliva samples were lost, which resulted in a total number of 245 valid measurements. The saliva samples were assayed in duplicate using commercially-available enzyme immunoassay kits (DRG International). The average of the duplicates were recorded for use in all analyses. The mean intra-assay and inter-assay coefficients of variation were 5.53% and 9.91%, respectively. In addition to the raw testosterone values, unstandardized residuals were created to assess overall change at the end of the experimental session from baseline (see Allison, 1990; Cronback & Furby, 1970). This process produces changes scores in testosterone at the end of the PSAP while controlling for initial measurements at the beginning of the study. The residuals were computed by regressing the last testosterone measurement onto the first testosterone measurement and saving the unstandardized residuals as created by

SPSS. This technique has been used in previous research of testosterone and aggression (e.g. Carré, Campbell, Lozoya, Goetz, & Welker, 2013; Mehta & Josephs, 2006).

Behavioral measures.

Participants' button presses from the PSAP were used to create unstandardized residuals for the aggression (button 2) option. Since participants varied in the amount of total button presses during the entire PSAP, it was necessary to assess the amount of displayed aggression, which was measured by the number of aggression (button 2) presses, while controlling for the amount of non-aggressive behavior during the separate rounds of the PSAP. This analytical strategy, which has been used by previous researchers examining aggression using the PSAP (Carré et al., 2013), removes variability in participants' aggressive behavior that is explained by the reward (button 1) and protection (button 3) presses. The residuals were created by regressing the number of aggression button presses onto the number of reward and protection button presses and saving the unstandardized residuals for all three rounds separately as well as an aggregate of the three rounds.

Manipulation check.

In the post-PSAP questionnaire participants were asked about their familiarity with the targets. When asked to indicate their agreement with the statement "The other player was familiar to me", participants in both the "ingroup" and "outgroup" condition expressed a low sense of familiarity with the targets (see Table 2). Additionally, the difference in familiarity between the White and Black target across both conditions was not statistically significant, $t(61) = -0.02$, $p = .980$. Similarly, comparisons of the

responses to the remainder of the post-PSAP questionnaire (see Table 2) also resulted in differences between the “ingroup” and “outgroup” conditions that were not statistically significant. Additionally, participants provided their thoughts on the PSAP and the other “player”. A sample of these replies can be found in Table 3. The questionnaire responses and the free-response comments suggest that participants generally perceived the PSAP to be a legitimate game and that the target face truly represented another participant.

Main Analyses

The primary hypothesis in this study was that individuals would behave more aggressively against the other “player” when playing with a member of an outgroup (compared to an ingroup member) and that this increase in aggression would be related to changes in testosterone throughout the PSAP. To test this hypothesis, several analyses were conducted using the raw and the residual scores for testosterone and the PSAP button presses.

A mixed-model ANOVA was conducted using the three residual scores of the aggression button presses as the within-subject factor with the experimental condition (ingroup vs. outgroup) as the between-subject factor. This analysis revealed a non-significant difference between the experimental conditions, $F(1, 61) = .02$, $p = .877$, $\eta^2 = < .001$. The expected interaction was not statistically significant, $F(1, 61) = .42$, $p = .519$, $\eta^2 = .007$. These data can be found in Figure 3. These results suggest that participants did not respond with different levels of aggression based on the group status of the other player. In addition to assessing differences in aggression, a 2 (condition: ingroup vs. outgroup) X 4 (raw testosterone scores) mixed-model ANOVA was conducted and

revealed non-significant differences between the experimental conditions, F(1, 55) = 1.16, p = .286, η^2 = .021, and a non-significant positive linear change in the testosterone values, F (1, 55) = 2.48, p = .121, η^2 =.043. This change was not qualified by the expected interaction, F(1 55) = 1.56, p = .217, η^2 = .028. These data can be found in Figure 4. Furthermore, an independent samples t-test showed that the testosterone residual scores did not differ between the ingroup and outgroup conditions, $t(58) = 1.49$, $p = .142$. $d = 0.39$

The overall relationship between participants' testosterone and aggressive behavior was examined through correlational analyses conducted between participants' testosterone residual scores, the three separate aggression residual scores, and the aggregate aggression residual score. As can be seen in Table 4, the testosterone residuals were not significantly correlated with any other aggression residuals. To explore the possibility that this relationship differed by the participants' assigned experimental condition, these analyses were conducted separately for each group. The results of these analyses can be found in Table 5, which show that the testosterone residuals were not correlated with the aggression residuals for the "ingroup" condition (all *r*s between -.04 and .11, *p*s between .565 and .923). For the "outgroup" condition, the testosterone residuals were statistically significantly correlated with the aggression residuals in the second ($r = .42$, $p = .019$) and third round ($r = .39$, $p = .029$) of the PSAP as well as the aggregate aggression residual ($r = .36$, $p = .049$).

Based on the observed relationship between the testosterone residuals and the second, third, and aggregate aggression residual, additional analyses were conducted to assess the moderating impact of the experimental condition (group status: ingroup

vs. outgroup) on these relationships using PROCESS, an SPSS macro developed by Hayes (2012, Model 1). In separate analyses, the three round-specific and aggregate aggression residuals were regressed onto the testosterone residual scores with the inclusion of the experimental condition as a moderator. These analyses produces a 95% confidence interval for the main effects and the interaction effect as well as the conditional effects of the moderator.

For the aggression residuals in the first PSAP round, the confidence intervals for both the main effect of testosterone change, [-0.50, 0.90], *b* = 0.20*, S.E.* = 0.35*, t* = 0.57*, p* = .57*,* and group status, [-37.01, 37.26], *b* = 0.12*, S.E.* = 18.54*, t* =0.01*, p* = .*99,* included 0. The confidence interval for the interaction effect included 0, [-1.10, 1.68] *b* = 0.29*, S.E.* = 0.69*, t* = 0.42*, p* = .68*,* as did the confidence intervals of the conditional effects for the ingroup, [-0.66, 0.76], *b* = 0.05*, S.E.* = 0.36*, t* = 0.14*, p* = .89*,* and for the outgroup, [-0.85, 1.53], *b* = 0.34*, S.E.* = 0.59*, t* = 0.57*, p* = .57. These data can be found in Figure 5. These results suggest that changes in testosterone and group status were not predictive of aggression in the first round of the PSAP.

For the aggression residuals in the second PSAP round, the confidence interval for the main effect of testosterone change included 0, [-0.06, 1.20], *b* = 0.57*, S.E.* = 0.31*, t* = 1.82*, p* = .07, although the outcomes were in the predicted direction and were marginally statistically significant. The confidence interval for the main effect of group status also did not include 0, [-15.71, 58.42], *b* = 21.35*, S.E.* = 18.50*, t* = 1.15*, p* = .25. The confidence interval for the interaction effect did not include 0, [0.05, 2.54], *b* = 1.30*, S.E.* = 0.62*, t* = 2.08*, p* = .04. When assessing the confidence intervals for the conditional effects, the ingroup condition did include 0, [-0.80, 0.61], *b* = -0.10*, S.E.* =

0.35, *t* = -0.27, *p* = .78, but the effect for the outgroup condition did not, [0.17, 2.23], *b* = 1.20, *S.E.* = 0.51, *t* = 2.34, *p* = .02. These data can be found in Figure 6. These results suggest that the predicted relationship between changes in testosterone and aggression were marginally present and that this relationship was moderated by group status of the other player. Importantly, the relationship was stronger for those playing with an outgroup member.

For the aggression residuals in the third PSAP round, the confidence interval for the main effect of testosterone change did not include 0, [0.17, 1.43], *b* = 0.80, *S.E.* = 0.31, *t* = 2.55, *p* = .01, but did include 0 for the main effect of group status, [-38.46, 21.57], *b* = -8.45, *S.E.* = 14.98, *t* = -0.56, *p* = .58. The confidence interval for the interaction effect included 0, [-0.05, 2.42], *b* = 1.19, *S.E.* = 0.62, *t* = 1.92, *p* = .06. The confidence intervals of the conditional effect for the ingroup did include 0, [-0.43, 0.80], *b* = 0.19, *S.E.* = 0.31, *t* = 0.61, *p* = .54, but the effect for the outgroup did not, [0.30, 2.45], *b* = 1.37, *S.E.* = 0.54, *t* = 2.57, *p* = .01. These data can be found in Figure 7. Although the interaction effect was only marginally statistically significant, the conditional effect was still present in the third round of the PSAP for participants paired with an outgroup member, which is similar to the findings from the second round.

For the aggregate aggression residuals across all three PSAP rounds, the confidence intervals for the main effect of testosterone change, [-0.07, 3.46], *b* = 1.69, *S.E.* = 0.88, *t* = 1.92, *p* = .06, and group status, [-83.15, 109.95], *b* = 13.40, *S.E.* = 48.20, *t* = 0.28, *p* = .78, included 0. It should be noted, however, that the results for the main effect of testosterone change were in the predicted direction and marginally statistically significant. The confidence interval for the interaction effect included 0, [-

0.92, 6.04], *b* = 2.56*, S.E.* = 1.74*, t* = 1.47*, p* = .15. The confidence intervals of the conditional effects for the ingroup, [-1.49, 2.24], *b* = 0.37*, S.E.* = 0.93*, t* = 0.40*, p* = .69, and for the outgroup, [-0.01, 5.87], *b* = 2.93*, S.E.* = 1.47*, t* = 2.00*, p* = .05, included 0. Again, the results for the outgroup were in the predicted direction and marginally statistically significant. These data can be found in Figure 8. Taken together, these results suggest that the predicted relationship between testosterone change and aggression was moderated by group status in the second and third rounds of the PSAP and that this effect resulted primarily from the stronger relationship in participants playing with an outgroup member.

Chapter 4

Discussion

The primary aim of the current research was to examine the factors related to interpersonal aggression with a focus on the influence of shared group status and changes in testosterone by placing participants into a situation in which they would be repeatedly provoked with the ability to respond aggressively. In general, the main hypotheses of this study were partially supported. Consistent with previous research on aggression (CITE ME), it was expected that aggressive behavior during the PSAP and changes in testosterone would be positively related. Although this relationship was not observed for the full set of participants, it was observed in the participants paired with a member of their respective racial outgroup during the second and third round of the PSAP. Furthermore, group status of the other player was identified as a moderator of this relationship. Finally, although group status showed some evidence of influence on physiological changes in participants, the hypothesized differences in preference for competition with outgroup members were not supported. Taken together, these results suggest that there are hormonal mechanisms that regulate interpersonal aggression toward ingroup and outgroup others with a specific focus on the impact of testosterone change and the degree of aggressiveness shown toward outgroup members.

The finding that participants' aggressiveness and changes in testosterone were related when playing the latter two of three rounds of the PSAP with an outgroup member is conceptually similar to previous research on group-based aggression. Previous work using the PSAP has shown that the overall level of aggressiveness shown by participants was positively related to changes in testosterone (Carré & McCormick, 2008; Carré et al., 2009; Carré et al., 2013; Carré, Iselin, Welker, Hariri, &

Dodge, 2014) as well as a preference for further competition that was predicted by increases in testosterone after the PSAP (Carré & McCormick, 2008). Furthermore, Oxford and colleagues (2010) found that when playing against experimentally-assigned outgroup members in a competitive game, individuals were more aggressive and showed increases in testosterone from baseline (compared to ingroup members). Previous researchers (Flinn et al., 2012) have offered explanations of these findings through the use of an evolutionary perspective. Specifically, individuals would have benefitted from suppressing aggressive urges and behaviors from ingroup members as a means of maintaining positive group relations. The more readily that individuals are able to identify similar others, the more likely they would be to confer advantages toward them. The use of racial identities in the current study provided a salient group identity for participants without the need for explicit instructions that they were to focus on group status. In the current study, increases in testosterone were related to higher levels of in aggression through two of the three blocks of the PSAP for participants who believed themselves to be playing with an outgroup member, while it was not found for those led to believe they were playing with an ingroup member. Although previous studies have studied aggression using the PSAP (Carré & McCormick, 2008; Carré et al., 2009; Carré et al., 2013; Carré, et al., 2014), those studies only provided participants with the belief they were playing with another player but did not include a visual image of this person. By experimentally manipulating the facial photograph of the other "player" along with a standardized cover story, the current study allows for an examination of how individuals respond behaviorally and physiologically to perceived provocation and competition from members of specific groups.

The current study's findings are similar to previous research examining the impact of group status in the neurological response to individuals' exposure to familiar and novel others. In one experiment, Phelps and colleagues (2000) placed White participants into an fMRI machine and exposed them to faces of unfamiliar Black or White males with a specific focus on the associations between amygdala activity during stimuli exposure and various measures of racial bias. The results from this study showed that although a majority of the participants showed a higher degree of amygdala activity when viewing the Black faces as compared to viewing the White faces, considerable variability in amygdala activity did not permit group-wide conclusions. Importantly, however, amygdala activity was related to a measure of race-specific implicit associations (IAT). A second study by the authors modified the initial design by exposing participants to faces of familiar and well-regarded White and Black celebrities. In general, the results of this second study showed that there were no consistent patterns of amygdala activity and that this activity was not related to either an explicit or implicit measure of racial bias.

Further research in this area by Richeson, Todd, Trawalter, and Baird (study 2, 2008) conducted a similar study which included an assessment of White participants' amygdala activity during exposure to unfamiliar White and Black faces with either a direct or averted gaze. The authors report that participants had a higher level of amygdala activity when exposed to Black faces with a direct gaze in comparison to White faces with a direct gaze. This difference was greatly reduced when both sets of faces were displaying an averted gaze. The authors interpret these results through a threat-detection mechanism, suggesting that the heightened response reflected an

increase in attention toward potentially threatening targets in the environment. Given the use of facial photographs with a direct gaze during the PSAP in the current research, it's possible that the inclusion of the target faces, rather than an unseen other, affected the perceptions of the PSAP as a competitive game and the provocative actions by the target as more or less aggressive.

Research focused on intergroup attitudes and behavior have repeatedly found that intergroup contact and familiarity are useful predictors of positive interpersonal interactions (Pettigrew and Tropp, 2006). For example, a study by Olsson, Ebert, Banaji, and Phelps (2005) used a classical conditioning paradigm to assess the readiness to associate the faces of racial ingroup and outgroup members with an aversive event. White and Black participants were exposed to pairs of Black and White faces, of which half of these faces were paired with an electric shock. Through the use of skin conductive response, it was found that both White and Black participants more strongly associated the electric shock with members of their respective racial outgroups. Importantly, it was also reported that individuals who reported having previous interracial romantic partnerships were likely to have lower levels of this outgroup bias. These authors suggest that these observed biases are not specific to inherent biases against one ethnic group or another, but rather a predisposition to associate fearful and aversive events to unfamiliar others and those who do not belong to the same social group. Through repeated interaction and the development of intimate relationships with outgroup members, group boundaries become weaker and positive attitudes are more likely to develop. Work by Telzer, Humphreys, Shapiro, and Tottenham, (2013) emphasizes the importance of neurological development and experience when

examining amygdala reactivity to outgroup faces. Using a sample of children aged 4-16, these researchers assessed amygdala activity during exposure to White and Black faces with a focus on the emergence of amygdala reactivity as a function of age and neurological development. Results showed that higher activity in the amygdala was positively correlated with age and that this correlation was specific to exposure to Black faces. This finding was found for both White and Black children. Importantly, this relationship was diminished when accounting for experienced peer diversity, such that participants with a racially diverse peer group displayed lower amygdala activity when exposed to Black faces. Similar findings have been reported by Telzer et al. (2013), emphasizing the influential effects of outgroup exposure during childhood development on amygdala sensitivity to others.

The current study adds to the body of research on aggression through the use of the PSAP and the inclusion of group status as a moderating variable. Although many studies conducted on the relationship between aggression and changes in testosterone often involve the use of naturally occurring (e.g. Wagner et al., 2002) or experimentally-created competition (Oxford et al., 2010), participants may not feel as though there is a compelling reason to restrict their aggressive behavior. Previous research examining aggression using the PSAP (Carré & McCormick, 2008; Carré et al., 2009; Carré et al., 2013; Carré, et al., 2014) have generally used cover stories in which participants are told that they will be playing a computer game with an unseen participant waiting in a nearby room. Although participants appear to believe the cover story, they never see a picture of this other (imaginary) participant or have any information from which to form an impression other than the scripted computer interactions. Although the absence of

this information is a means to maintain experimental control by reducing the number of potential variables that might be confounded with any observed aggressive behavior, aggression in the PSAP is directed at a specific person or target. Having knowledge of who is doing the provoking and to whom one's aggression would be directed would likely promote more strategic behavioral choices. Rather than aggressing against a nameless and faceless entity, individuals might be motivated to suppress their aggressive urges against a friend or fellow classmate as compared to an unknown other, especially if they expect to interact with the other player once the experimental session has ended. Furthermore, although previous uses of the PSAP have revealed a relationship between aggressive behavior and changes in testosterone, the amount of variability explained has been small to moderate (e.g. 7.2%, Carré et al., 2013, p. 2038; 14.4%, Carré & McCormick, 2008). Given that naturally produced aggression is often directed at others based on complex social information provided by the actor and the target, the inclusion of variables that are directly related to the expression of aggressive behavior would be useful to fully understand the nature of this relationship.

In comparison to previous work on examining causal relationship between changes in testosterone and aggression, in which researchers artificially increase testosterone levels in participants (e.g., Kouri et al., 1995) or manipulate the degree or type of provocation experienced by participants (e.g., Carré et al., 2010), the current research design did not permit for making causal inferences as to whether changes in testosterone are more influential on aggressive behavior or the reverse. The current results, however, do provide some useful insight into this relationship. Importantly, the nature of the PSAP provides a prolonged interpersonal interaction in which participants

believe they can understand the intentions and motivations of the other player to inform their own behaviors (e.g., see the responses in Table 3). The round-specific associations found between changes in testosterone and aggression suggest that the participants' aggressive behavior may ultimately be the underlying cause for the change in testosterone. During the first round of the PSAP participants may start out with good intentions to not aggress toward the other player, but as participants encounter numerous provocations they may experience a change in strategy. This change, as a response to perceived interpersonal challenge and practical threat (i.e., a loss of points is believed to result in a loss of money as a study reward), may then prompt changes in testosterone to reinforce behaviors that are consistent with one's situation and motivated concerns (Mazur, 1985; Wingfield et al., 1990). Again, the current design does not allow for making strong causal inferences, but the round-specific findings are suggestive of this pattern.

Study Limitations

In general, the current study replicated findings in previous research that have found relationships between aggression and testosterone (Archer et al., 2005; Archer, 2006) and the influence of group status on aggressive behavior and changes in testosterone (Greitemeyer, 2013; Oxford et al., 2010). Although the current study also resembles previous work using a similar methodology (e.g. playing games with others; Carré, et al., 2009; Carré et al., 2010; Greitemeyer, 2013; Kouri et al., 1995), there may have been several important methodological differences that ultimately served to minimize the measured effect. For example, Oxford and colleagues (2010) had participants play a violent video game on a commercial game system with multiple

teammates against other teams of participants as well as against their own teammates. Although these teams were created in the laboratory with the participants having no interaction prior to the experiment, the authors found that participants experienced an increase in testosterone when playing against an opposing team (compared to playing against their teammates) and that this increase was related to the in-game contribution of the winning players during the competition. In contrast, the use of the PSAP in the current research may have been too passive of a game to produce the expected differences in aggressive behavior. Specifically, the PSAP required participants to passively sit at a computer workstation in isolation and press a series of buttons for three 7-minute periods. Participants provided both qualitative and quantitative data suggesting they perceived the experimental setting as authentic; however, the degree of physical and mental exertion would have been much less than that of a violent team-based video game. Similarly, the use of static facial photographs to represent the other player may have produced weaker effects than the use of an in-person interaction. Although the target faces were chosen based on the pre-rating of select traits, the use of a confederate may have increased feelings of competitiveness and aggressiveness in the participants.

Work by Flinn and colleagues (2012) found a relationship between group status and changes in testosterone using existing real-world groups engaged in competition. Specifically, the authors used participants who shared a community-based social identity and observed them playing a competitive game of Dominoes with opponents who were members of a different community. In contrast, the current research relied on participants to self-identify with their own racial identity (i.e. White vs. Black) and to also

identify the opposing player as a member of their ingroup or outgroup. Given the racially diverse population of Wayne State University, students may have simply ignored or suppressed the use of racial identities during the PSAP. Alternatively, participants' familiarity of various racial outgroups, which is likely to result from attending a large university with a diverse student body, may have attenuated both physiological and neurological reactivity upon exposure to the novel outgroup faces. As a result, the manipulation of the target face may not have produced weaker outcomes than expected because the participants did not readily attend to or place great importance on the identity-relevant stimuli cues as expected.

An additional limitation on the current study was that participants' attitudes toward their (and others') racial group were not measured. Previous research has identified that negative explicit and implicit attitudes toward various racial groups are predictive of discriminatory behavior (Schutz & Six, 1996). The inclusion of these measures may have been useful as additional predictors or moderators of overall aggression. For example, individuals with negative attitudes toward racial outgroup members might respond more aggressively in response to provocation from an outgroup member than an ingroup member, while an individual with egalitarian attitudes may choose to respond in a similar fashion to both ingroup and outgroup provocation. The inclusion of these measures would have been particularly useful as prejudiced individuals are more likely to act in a manner consistent with their attitudes if they are provided with justification for discrimination (e.g. provocation during the PSAP; see Crandall & Eshleman, 2003; Graziano, Bruce, Sheese, & Tobin, 2007). It would be predicted that individuals who harbor negative intergroup attitudes toward the target

outgroup would show stronger associations between aggression and changes in testosterone, as compared to those with positive attitudes.

In addition to issues related to the experimental manipulation of target faces, the experimental setting may not have been the most reliable way to stimulate the desired aggressive behavior. In contrast to studies measuring proactive aggression, such as direct competition in a team-based video game (e.g. Greitemeyer, 2013; Oxford et al., 2010), the current research measured reactive aggression through the use of the PSAP. In the PSAP participants are explicitly instructed that they will be rewarded based on the number of points they received during the game and the instructions purposefully avoided using language that would otherwise encourage participants to be aggressive (e.g. “opponent”, “punish”, “winners”, “losers”). Although this was done to avoid influencing participants, the ability to play the PSAP without directly requiring aggression may have produced diminished effects. The main hypotheses were reliant upon the expectation that individuals would react more aggressively to a provocation by an outgroup member as compared to an ingroup member. Previous research by Flinn and colleagues (2012; see also Oxford et al., 2010) found that when individuals were victorious in a competitive game against outgroup members, there was an increase in testosterone. In contrast, this increase was muted when victorious against ingroup members, which the authors interpreted as a means of maintaining social bonds. In relation to the current research, the possibility that participants could avoid interacting with the other player in the PSAP (i.e. only choosing button 1 to gain points and not choosing button 2 or 3) may have reduced the need to justify one’s aggressive behavior, especially toward an ingroup member. Previous work, however, has shown

the PSAP to be a reliable way to produce reactive aggression (Carré et al., 2010; Kouri et al., 1995) and that aggressive behavior in the PSAP is related to changes in testosterone (Carré et al., 2010). These past studies have not included target manipulations or the use of facial photographs into their methodologies and have instead focused primarily on the participants' traits and characteristics (e.g. facial features, personality differences) as predictors of aggression (Carré, McCormick, & Mondloch, 2009). As a result, it's difficult to conclude with confidence as to how the mechanics of the PSAP interact with the inclusion of group status as an additional experimental manipulation. Additional work will be necessary to identify whether or not the PSAP is an appropriate tool for studying intergroup aggression.

Future Directions

Although the current study did partially produced the expected results, the general methodology does provide some suggestions for future lines of research for aggression research in general as well as specific uses of the PSAP. In particular, the PSAP is generally described to participants as a game they will be playing with another unseen player. Although an appropriate cover story may serve to give the impression that the other player is a real player, the use of facial photographs to represent the other player is a novel approach. As evidenced by comments made by the participants in the current research, the use of these photographs appeared to satisfy any doubts they had as to the validity of the cover story. More importantly, however, is that the facial photographs could easily be changed to fit a number of experimental manipulations. For example, research on facial self-resemblance has shown that individuals have a tendency to report more positive attitudes and behave more cooperatively toward those

who have similar facial features as the individual (DeBruine, 2002; Krupp, DeBruine, & Barclay, 2008; but see Giang, Bell, & Buchner, 2012). Using a two-session experiment, it may be possible to digitally create target faces that resemble participants on a case-by-case basis. By doing so, this would allow the researcher to create self-resembling or non-resembling faces to assess the impact of similarity on aggressive tendencies in response to provocation. In addition to facial similarity, masculine facial characteristics have been found to be related to high level of testosterone (Penton-Voak & Chen, 2004) and these features are used as cues of interpersonal trustworthiness (Buckingham et al., 2006) and behavioral aggression (Carré et al., 2009). As a result, one potential avenue for research would be to systematically vary the facial features of the target faces through pre-ratings of facial stimuli or by digitally manipulating faces to have more or less masculine features. This would allow the researcher to control for a number of facial characteristics while still affecting the perceptions and expectations of the participants.

The most novel addition of the current research to the work done using the PSAP was the inclusion of group conditions as an active manipulation. In particular, this study was primarily focused on the response of participants in the face of provocation and whether or not changes in testosterone would be associated with aggressive behavior. This resembles previous work that has also examined the relationship between aggression and testosterone but specifically included the group manipulations (shared or unshared social identity) to examine how individuals respond to provocation from ingroup and outgroup members. Although the use of racial identities as a salient group identity may be an easily introduced manipulation, it may be more informative to use

experimentally created groups (i.e. minimal group paradigm; Tajfel et al., 1971) to reduce the impact of pre-existing attitudes and experiences. Previous research has shown that experimentally-created shared group status is predictive of favorable attitudes and behavior (Brewer, 1979; Otten & Moskowitz, 2000; Tajfel et al., 1971). The inclusion of group status manipulations when using the PSAP may provide additional information related to the process of aggression as well as aggression-inhibition, or the process by which individuals desire to respond aggressively to acts of provocation but choose selectively suppress these behaviors when it may be harmful to one's valued interpersonal relationships.

General Conclusions

In summary, the current research was directed at understanding the relationship between aggression and changes in testosterone with a focus on the impact of group status and the selective application of aggression. Although not all of the main hypotheses were supported, there was data suggesting that group status was useful for understanding this relationship. Based on the current findings, individuals do appear to respond physiologically different to competition with ingroup and outgroup members and this difference is related to the behavioral aggression toward these others. Multiple study limitations were identified with a focus on potential avenues for improving the use of group status manipulations in the PSAP for studying aggression and retaliation. Furthermore, additional manipulations (e.g. variation in masculinity and self-resemblance) were suggested as they would allow researchers to systematically manipulate the perceptions of future participants while still allowing for a realistic experimental setting. Importantly, the use of group status manipulations in the current

research was a novel addition to previous uses of the PSAP and this addition may open up new possibilities toward future aggression research.

APPENDIX A

You will be presented with various phrases that describe people's traits and behaviors. Please use the rating scale to describe how accurately each statement describes you. So that you can describe yourself in an honest manner, your responses will be kept in absolute confidence.

When responding, please describe yourself as you generally are now, not as you wish to be in the future. Describe yourself as you honestly see yourself, in relation to other people you know of the same sex as you are, and roughly your same age.

Please read each statement carefully before selecting your response.

Not at all like me	Not like me	Not much like me	Neutral	Somewhat like me	Like me	Just like me
○	○	○	○	○	○	○

Fairness

1. Would never take things that aren't mine.
2. Would never cheat on my taxes.
3. Returns change when a cashier makes a mistake.
4. Would feel very badly for a long time if I were to steal from somebody.
5. Tries to follow the rules.
6. Admires a really clever scam.*
7. Cheats to get ahead.*
8. Steals things.*
9. Cheats on people who have trusted me.*
10. Would not regret my behavior if I were to take advantage of someone impulsively.*

Aggressiveness

1. Get angry easily.
2. Get irritated easily.
3. Get upset easily.
4. Am often in a bad mood.
5. Lose my temper.
6. Rarely get irritated.*
7. Seldom get mad.*
8. Am not easily annoyed.*
9. Keep my cool.*
10. Rarely complain.*

Cooperativeness

1. Am easy to satisfy.
2. Can't stand confrontations.
3. Hate to seem pushy.
4. Have a sharp tongue.*
5. Contradict others.*
6. Love a good fight.*
7. Yell at people.*
8. Insult people.*
9. Get back at others.*
10. Hold a grudge.*

Dominance

1. Try to surpass others' accomplishments.
2. Try to outdo others.
3. Am quick to correct others.
4. Impose my will on others.

5. Want to control the conversation.
6. Am not afraid of providing criticism.
7. Challenge others' points of view.
8. Lay down the law to others.
9. Put people under pressure.
10. Hate to seem pushy.*

Self-Esteem

1. Feel comfortable with myself.
2. Just know that I will be a success.
3. Seldom feel blue.
4. Like to take responsibility for making decisions.
5. Know my strengths.
6. Dislike myself.*
7. Am less capable than most people.*
8. Feel that my life lacks direction.*
9. Question my ability to do my work properly.*
10. Feel that I'm unable to deal with things.*

Extraversion

1. Extroverted and enthusiastic.
2. Reserved and quiet.*

Agreeableness

1. Critical and quarrelsome.
2. Sympathetic and warm.*

Conscientiousness

1. Dependable and self-disciplined.
2. Disorganized and careless.*

Openness

1. Open to new experiences and complex.
2. Conventional and uncreative.*

Neuroticism

1. Anxious and easily upset.*
2. Calm and emotionally stable.

Note: * = item is reversed scored.

APPENDIX B

On the following pages, there are general statements describing your reactions to the decision making task you just completed. When appropriate, please use the provided rating scale to indicate your agreement or disagreement with these statements. Please read each statement carefully before selecting your answer.

Strongly Disagree	Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Agree	Strongly Agree
○	○	○	○	○	○	○

1. I enjoyed playing this game.
2. I enjoyed playing with the other player.
3. The other player played fairly.
4. I would like to play this game in the future.
5. I would enjoy playing a team-based task with the other player.
6. The other player was familiar to me.
7. I earned more points than the other player.
8. I removed more points from the other player than were stolen from me.
9. Please describe any impression(s) you formed about the other player in the space below:

APPENDIX C

1. Please indicate your age.
2. Please indicate your gender

Male	Female
○	○

3. Please indicate your class year

Freshman	Sophomore	Junior	Senior
○	○	○	○

4. Please indicate your race.

Caucasian / White	African American/Black	Asian	American Indian	Bi- or multiracial	Other ☐
○	○	○	○	○	○

5. What is your current marital status?

Married	Living with partner	Widowed	Separated	Divorced	In a relationship	Single
○	○	○	○	○	○	○

6. Please indicate how many alcoholic beverages you consume per week.

none	1-2 drinks	3-4 drinks	5-6 drinks	more than 7 drinks
○	○	○	○	○

7. How many cigarettes do you smoke per week?

I do not smoke	1 or 2	3 or 4	5 or 6	7 or more
○	○	○	○	○

8. How many hours of sleep do you get per night?

2-3 hours	4-5 hours	6-7	8-9 hours	more than 10

hours

9. Do you take any prescription medication?

Yes No

10. If “yes” to #9, please provide the name and reason for taking this medication:

REFERENCES

Allison, P. D. (1990). Change scores as dependent variables in regression analysis. *Sociological methodology, 20*, 93-114. doi: 10.2307/271083

Apicella, C. L., Dreber, A., Campbell, B., Gray, P. B., Hoffman, M., & Little, A. C. (2008). Testosterone and financial risk preferences. *Evolution and Human Behavior, 29*(6), 384-390. doi: 10.1016/j.evolhumbehav.2008.07.001

Archer, J. (1991). The influence of testosterone on human aggression. *British Journal of Psychology, 82*(1), 1-28. doi: 10.1111/j.2044-8295.1991.tb02379.x

Archer, J. (2006). Testosterone and human aggression: An evaluation of the challenge hypothesis. *Neuroscience & Biobehavioral Reviews, 30*(3), 319-345. doi: 10.1016/j.neubiorev.2004.12.007

Archer, J., Graham-Kevan, N., & Davies, M. (2005). Testosterone and aggression: A reanalysis of Book, Starzyk, and Quinsey's (2001) study. *Aggression and Violent Behavior, 10*(2), 241-261. doi: 10.1016/j.avb.2004.01.001

Ashburn-Nardo, L., Voils, C. I., & Monteith, M. J. (2001). Implicit associations as the seeds of intergroup bias: How easily do they take root? *Journal of Personality and Social Psychology, 81*(5), 789-799. doi: 10.1037/0022-3514.81.5.789

Avenanti, A., Sirigu, A., & Aglioti, S. M. (2010). Racial bias reduces empathic sensorimotor resonance with other-race pain. *Current Biology, 20*, 1018-1022. doi: 10.1016/j.cub.2010.03.071

Bagby, M. R., & Rector, N. A. (1992). Prejudice in a simulated legal context: A further application of social identity theory. *European Journal of Social Psychology, 22*(4), 397-406. doi: 10.1002/ejsp.2420220408

Bartz, J. A., Zaki, J., Bolger, N., & Ochsner, K. N. (2011). Social effects of oxytocin in humans: Context and person matter. *TRENDS in Cogintive Sciences, 15*(7), 301-309. doi: 10.1016/j.tics.2011.05.002

Baumgartner, T., Heinrichs, M., Vonlanthen, A., Fischbacher, U., & Fehr, E. (2008). Oxytocin shapes the neural circuitry of trust and trust adaptation in humans. *Neuron, 58*(4), 639-650. doi: 10.1016/j.neuron.2008.04.009

Bernhardt, P. C., Dabbs, J. M. J., Fielden, J. A., & Lutter, C. D. (1998). Testosterone changes during vicarious experiences of winning and losing among fans at sporting events. *Physiology & Behavior, 65*(1), 59-62. doi: 10.1016/S0031-9384(98)00147-4

Bettencourt, B. A., Charlton, K., Dorr, N., & Hume, D. L. (2001). Status differences and in-group bias: A meta-analytic examination of the effects of status stability, status legitmacy, and group permeability. *Psychological Bulletin, 127*(4), 520-542. doi: 10.1037/0033-2909.127.4.520

Billig, M. G., & Tajfel, H. (1973). Social categorization and similarity in intergroup behvaior. *European Journal of Social Psychology, 3*(1), 27-52. doi: 10.1002/ejsp.2420030103

Blair, I. V., Judd, C. M., & Fallman, J., L. (2004). The automaticity of race and afrocentric facial features in social judgments. *Journal of Personality and Social Psychology, 87*(6), 763-778. doi: 10.1037/0022-3514.87.6.763

Brewer, M. B. (1979). In-group bias and the minimal group situation: A cognitive motivational analysis. *Psychological Bulletin, 86*, 307-324. doi: 10.1111/0022-4537.00126

Brewer, M. B. (1999). The psychology of prejudice: Ingroup love or outgroup hate? *Journal of Social Issues, 55*(3), 429-444. doi: 10.1111/0022-4537.00126

Brewer, M. B., & Lui, L. N. (1989). The primacy of age and sex in the structure of person categories. *Social Cognition, 7*(3), 262-274.

Buckingham, G., DeBruine, L. M., Little, A. C., Welling, L. L., Conway, C. A., Tiddeman, B. P., & Jones, B. C. (2006). Visual adaptation to masculine and feminine faces influences generalized preferences and perceptions of trustworthiness. *Evolution and Human Behavior, 27*(5), 381-389. doi: 10.1016/j.evolhumbehav.2006.03.001

Burnham, T. C. (2007). High-testosterone men reject low ultimatum game offers. *Proceedings of the Royal Society: Biological Sciences, 274*(1623), 2327-2330. doi: 10.1098/rspb.2007.0546

Campbell, A. (2010). Oxytocin and human social behavior. *Personality and Social Psychology Review, 14*(3), 281-295. doi: 10.1177/1088868310363594

Carré, J. M., Campbell, J. A., Lozoya, E., Goetz, S. M. M., & Welker, K. M. (2013). Changes in testosterone mediate the effect of winning on subsequent aggressive behaviour. *Psychoneuroendocrinology, 38*(10), 2034-2041. doi: 10.1016/j.psyneuen.2013.03.008

Carré, J. M., Gilchrist, J. D., Morrissey, M. D., & McCormick, C. M. (2010). Motivational and situational factors and the relationship between testosterone dynamics and human aggression during competition *Biological Psychology, 84*, 346-353. doi: 10.1016/j.biopsycho.2010.04.001

Carré, J. M., Iselin, A.-M. R., Welker, K. M., Hariri, A. R., & Dodge, K. A. (2014). Testosterone reactivity to provocation mediates the effect of early intervention on

aggressive behavior. *Psychological Science, 25*(5), 1140-1146. doi: 10.1177/0956797614525642

Carré, J. M., & McCormick, C. M. (2008). Aggressive behavior and change in salivary testosterone concentrations predict willingness to engage in a competitive task *Hormones and Behavior, 54*(3), 403-409. doi: 10.1016/j.yhbeh.2008.04.008

Carré, J. M., McCormick, C. M., & Mondloch, C. J. (2009). Facial structure is a reliable cue of aggressive behavior. *Psychological Science, 20*(10), 1194-1198. doi: 10.1111/j.1467-9280.2009.02423.x

Carré, J. M., & Putnam, S. K. (2010). Watching a previous victory produces an increase in testosterone among elite hockey players. *Psychoneuroendocrinology, 35*(3), 475-479. doi: 10.1016/j.psyneuen.2009.09.011

Carré, J. M., Putnam, S. K., & McCormick, C. M. (2009). Testosterone responses to competition predict future aggressive behaviour at a cost to reward in men. *Psychoneuroendocrinology, 34*(4), 561-570. doi: 10.1016/j.psyneuen.2008.10.018

Cherek, D. R. (1981). Effects of smoking different doses of nicotine on human aggressive behavior. *Psychopharmacology, 75*(4), 339-345. doi: 10.1007/BF00435849

Collaer, M. L., & Hines, M. (1995). Human behavioral sex differences: A role for gonadal hormones during early development? *Psychological Bulletin, 118*(1), 55-107.

Cottrell, C., A., & Neuberg, S. L. (2005). Different emotional reactions to different groups: A sociofunctional threat-based approach to "prejudice". *Journal of*

Personality and Social Psychology, 88(5), 770-789. doi: 10.1037/0022-3514.88.5.770

Crandall, C. S., & Eshleman, A. (2003). A justification-suppression model of the expression and experience of prejudice. *Psychological Bulletin, 129*(3), 414-446.

Cronbach, L. J., & Furby, L. (1970). How we should measure" change": Or should we? *Psychological Bulletin, 74*(1), 68-80. doi: 10.1037/h0029382

Dabbs, J. M. J., Carr, T. S., Frady, R. L., & Riad, J. K. (1995). Testosterone, crime, and misbehavior among 692 male prison inmates. *Personality and Individual Differences, 18*(5), 627-633. doi: 10.1016/0191-8869(94)00177-T

Dabbs, J. M. J., & Morris, R. (1990). Testosterone, social class, and antisocial behavior in a sample of 4,462 men. *Psychological Science, 1*(3), 209-211. doi: 10.1111/j.1467-9280.1990.tb00200.x

De Dreu, C. K. W. (2012). Oxytocin modulates cooperation within and competition between groups: An integrative review and research agenda. *Hormones and Behavior, 61*(3), 419-428. doi: 10.1016/j.yhbeh.2011.12.009,

De Dreu, C. K. W., Greer, L. L., Handgraaf, M. J. J., Shalvi, S., Van Kleef, G. A., Baas, M., . . . Feith, S. W. W. (2010). The neuropeptide oxytocin regulates parochial altruism in intergroup conflict among humans. *Science, 328*(5984), 1408-1411. doi: 10.1126/science.1189047

De Dreu, C. K. W., Greer, L. L., Van Kleef, G. A., Shalvi, S., & Handgraaf, M. J. J. (2005). Oxytocin promotes human ethnocentrism. *Proceedings of the National Academy of Sciences of the United States of American, 108*(4), 1262-1266. doi: 10.1073/pnas.1015316108

DeBruine, L. (2002). Facial resemblance enhances trust. *Proceedings of the Royal Society: Biological Sciences, 269*, 1307-1312. doi: 10.1098/rspb.2002.2034

Devine, P. (1989). Stereotypes and prejudice: Their automatic and controlled components. *Journal of Personality and Social Psychology, 56*(1), 5-18. doi: 10.1037/0022-3514.56.1.5

Ehrenkranz, J., Bliss, E., & Sheard, M. H. (1974). Plasma testosterone: Correlation with aggressive behavior and social dominance in man. *Psychosomatic Medicine, 36*(6), 469-475.

Esses, V. M., Dovidio, J. F., Jackson, L. M., & Armstrong, T. L. (2001). The immigration dilemma: The role of perceived group competition, ethnic prejudice, and national identity. *Journal of Social Issues, 57*(3), 389-412. doi: 10.1111/0022-4537.00220

Faul, F., Erdfelder, E., Lang, A.-G., & Buchner, A. (2007). G*Power 3: A flexible statistical power analysis program for the social, behavioral, and biomedical sciences *Behavior Research Methods, 39*(2), 175-191. doi: 10.3758/BF03193146

Feldman, R., Weller, A., Zagoory-Sharon, O., & Levine, A. (2007). Evidence for a neuroendocrinological foundation of human affiliation: Plasma oxytocin levels across pregnancy and the postpartum period predict mother-infant bonding. *Psychological Science, 18*(11), 965-970. doi: 10.1111/j.1467-9280.2007.02010.x

Fishbein, H. D. (1996). *Peer prejudice and discrimination: Evolutionary, cultural, and developmental dynamic*. Boulder, CO, US: Westview Press.

Flinn, M. V., Ponzi, D., & Muehlenbein, M. P. (2012). Hormonal mechanisms for regulation of aggression in human coalitions. *Human Nature, 23*(1), 68-88. doi: 10.1007/s12110-012-9135-y

Giang, T., Bell, R., & Buchner, A. (2012). Does facial resemblance enhance cooperation? *PLoS ONE, 7*(10), e47809. doi: 10.1371/journal.pone.0047809

Gilbert, D. T., & Hixon, J. G. (1991). The trouble of thinking: Activation and application of stereotypic beliefs. *Journal of Personality and Social Psychology, 60*(4), 509-517. doi: 10.1037/0022-3514.60.4.509

Goldberg, L. R., Johnson, J. A., Eber, H. W., Hogan, R., Ashton, M. C., Cloninger, C. R., & Gough, H. G. (2006). The international personality item pool and the future of public-domain personality measures. *Journal of Research in Personality, 40*(1), 84-96. doi: 10.1016/j.jrp.2005.08.007

Gordon, I., Zagoory-Sharon, O., Leckman, J. F., & Feldman, R. (2010). Oxytocin and the development of parenting in humans. *Biological Psychiatry, 68*(4), 377-382. doi: 10.1016/j.biopsych.2010.02.005

Graziano, W. G., Bruce, J., Sheese, B. E., & Tobin, R. M. (2007). Attraction, personality, and prejudice: liking none of the people most of the time. *Journal of Personality and Social Psychology, 93*(4), 565. doi: 10.1037/0022-3514.93.4.565

Greenwald, A. G., McGhee, D. E., & Schwartz, J. L. K. (1998). Measuring individual differences in implicit cognition: The implicit association test *Journal of Personality and Social Psychology, 74*(6), 1464-1480 doi: 10.1037/0022-3514.74.6.1464

Greitemeyer, T. (2013). Playing violent video games increases intergroup bias. *Personality and Social Psychology Bulletin*, 0146167213505872. doi: 10.1177/0146167213505872

Hamilton, W. D. (1964). The genetical evolution of social behaviour. I. *Journal of Theoretical Biology, 7*(1), 1-16. doi: 10.1016/0022-5193(64)90038-4

Hansen, L., Bangsbo, J., Twisk, J., & Klausen, K. (1999). Development of muscle strength in relation to training level and testosterone in young male soccer players. *Journal of Applied Physiology, 87*(3), 1141-1147.

Hartstone, M., & Augoustinos, M. (1995). The minimal group paradigm: Categorization into two versus three groups. *European Journal of Social Psychology, 25*(2), 179-193. doi: 10.1002/ejsp.2420250205

Hayes, A. F. (2012). PROCESS: A versatile computational tool for observed variable mediation, moderation, and conditional process modeling [White paper]. Retrieved from http://www.afhayes.com/public/process2012.pdf

Hertel, G., & Kerr, N. L. (2001). Priming in-group favortism: The impact of normative scripts in the minimal group paradigm. *Journal of Experimental Social Psychology, 37*(4), 316-324. doi: 10.1006/jesp.2000.1447

Hewstone, M., Hantzi, A., & Johnson, L. (1991). Social categorization and person memory: The pervasiveness of race as an organizing principle. *European Journal of Social Psychology, 21*(6), 517-528. doi: 10.1002/ejsp.2420210606

Jackson, L. M., & Esses, V. M. (2000). Effects of perceived economic competition on people's willingness to help empower immigrants. *Group Processes & Intergroup Relations, 3*(4), 419-435. doi: 10.1177/1368430200003004006

Johnson, R. T., Burk, J. A., & Kirkpatrick, L. A. (2007). Dominance and prestige as differential predictors of aggression and testosterone levels in men. *Evolution and Human Behavior, 28*(5), 345-351. doi: 10.1016/j.evolhumbehav.2007.04.003

Kosfeld, M., Heinrichs, M., Zak, P. J., Fischbacher, U., & Fehr, E. (2005). Oxytocin increases trust in humans *Nature, 435*(2), 673-676. doi: 10.1038/nature03701

Kouri, E. M., Lukas, S. E., Pope, H. G. J., & Oliva, P. S. (1995). Increased aggressive responding in male volunteers following the administration of gradually increasing doses of testosterone cypionate. *Drug and Alcohol Dependence, 40*(1), 73-79. doi: 10.1016/0376-8716(95)01192-7

Krupp, D. B., DeBruine, L., & Barclay, P. (2008). A cue of kinship promotes cooperation for the public good. *Evolution and Human Behavior, 29*, 49-55. doi: 10.1016/j.evolhumbehav.2007.08.002

Kteily, N. S., Sidanius, J., & Levin, S. (2011). Social dominance orientation: Cause or 'mere effect'? Evidence for SDO as a causal predictor of prejudice and discrimination against ethnic and racial outgroups. *Journal of Experimental Social Psychology, 47*, 208-214. doi: 10.1016/j.jesp.2010.09.009

Kurzban, R., & Christener, J. (in press). Are supernatural beliefs commitment devices for intergroup conflict? In J. P. Forgas, A. W. Kruglanski & K. D. Williams (Eds.), *The psychology of social conflict and aggression* (Vol. 13): The Sydney Symposium of Social Psychology,.

Kurzban, R., Tooby, J., & Cosmides, L. (2001). Can race be erased? Coalitional computation and social categorization. *Proceedings of the National Academy of Sciences of the United States of American, 98*(26), 15387-15392. doi: 10.1073/pnas.251541498

Lee, H.-J., Macbeth, A. H., Pagani, J., & Young, W. S. r. (2009). Oxytocin: The great facilitator of life *Progress in Neurobiology, 88*(2), 127-151. doi: 10.1016/j.pneurobio.2009.04.001

LeVine, R. A., & Campbell, D. T. (1972). *Ethnocentrism: Theories of conflict, ethnic attitudes and group behavior*. New York, NY, US: Wiley.

Macrae, C. N., & Bodenhausen, G. V. (2000). Social cognition: Thinking categorically about others. *Annual Review of Psychology, 51*, 93-120. doi: 10.1146/annurev.psych.51.1.93

Macrae, C. N., & Bodenhausen, G. V. (2001). Social cognition: Categorical person perception. *British Journal of Social Psychology, 92*, 239-255. doi: 10.1348/000712601162059

Martin, D., & Macrae, C. N. (2007). A face with a cue: Exploring the inevitability of person categorization. *European Journal of Social Psychology, 37*, 806-816. doi: 10.1002/ejsp.445

Mazur, A. (1985). A biosocial model of status in face-to-face primate groups. *Social Forces, 64*(2), 377-402. doi: 10.1093/sf/64.2.377

Mazur, A., & Booth, A. (1998). Testosterone and dominance in men *Behavioral and Brain Sciences, 21*(3), 353-363.

Mazur, A., Booth, A., & Dabbs, J. M. J. (1992). Testosterone and chess competition. *Social Psychology Quarterly, 55*(1), 70-77.

Mazur, A., & Lamb, T. A. (1980). Testosterone, status, and mood in human males. *Hormones and Behavior, 14*(3), 236-246. doi: 10.1016/0018-506X(80)90032-X

McCaul, K. D., Gladue, B. A., & Joppa, M. (1992). Winning, losing, mood, and testosterone. *Hormones and Behavior, 26*(4), 486-504. doi: 10.1016/0018-506X(92)90016-O

Mehta, P. H., & Josephs, R. A. (2006). Testosterone change after losing predicts the decision to compete again. *Hormones and Behavior, 50*(5), 684-692. doi: 10.1016/j.yhbeh.2006.07.001

Nelson, R. J., & Chiavegatto, S. (2001). Molecular basis of aggression. *TRENDS in Neurosciences, 24*(12), 713-719. doi: 10.1016/S0166-2236(00)01996-2

Neuberg, S. L., & Cottrell, C., A. (2008). Managing the threats and opportunities afforded by human sociality. *Group Dynamics: Theory, Research, and Practice, 12*(1), 63-72. doi: 10.1037/1089-2699.12.1.63

Olsson, A., Ebert, J. P., Banaji, M. R., & Phelps, E. A. (2005). The role of social groups in the persistance of learned fear. *Science, 309*(5735), 785-787. doi: 10.1126/science.1113551

Olweus, D., Mattsson, A., Schalling, D., & Lõw, H. (1988). Circulating testosterone levels and aggression in adolescent males: A causal analysis. *Psychosomatic Medicine, 50*(3), 261-272.

Otten, S., & Moskowitz, G. B. (2000). Evidence for implicit evaluative in-group bias: Affect-biased spontaneous trait inference in a minimal group paradigm. *Journal of Experimental Social Psychology, 36*(1), 77-89. doi: 10.1006/jesp.1999.1399

Oxford, J., Ponzi, D., & Geary, D. C. (2010). Hormonal responses differ when playing violent video games against an ingroup and outgroup. *Evolution and Human Behavior, 31*(3), 201-209. doi: 10.1016/j.evolhumbehav.2009.07.002

Penton-Voak, I. S., & Chen, J. Y. (2004). High salivary testosterone is linked to masculine male facial appearance in humans. *Evolution and Human Behavior, 25*(4), 229-241. doi: 10.1016/j.evolhumbehav.2004.04.003

Pettigrew, T. F., & Tropp, L. R. (2006). A meta-analytic test of intergroup contact theory. *Journal of Personality and Social Psychology, 90*(5), 751-783. doi: 10.1037/0022-3514.90.5.751

Phelps, E. A., O'Conner, K. J., Cunningham, W. A., Funayama, E. S., Gatenby, J. C., Gore, J. C., & Banaji, M. R. (2000). Performance on indirect measures of race evaluation predicts amygdala activation. *Journal of Cognitive Neuroscience, 12*, 729-738. doi: 10.1162/089892900562552

Pope, H. G. J., Kouri, E. M., & Hudson, J. I. (2000). Effects of supraphysiologic doses of testosterone on mood and aggression in normal men: A randomized controlled trial. *Archives of General Psychiatry, 57*(2), 133-140. doi: 10.1001/archpsyc.57.2.133

Quinn, K. A., & Macrae, C. N. (2005). Categorizing others: The dynamics of person construal. *Journal of Personality and Social Psychology, 88*(3), 467-479. doi: 10.1037/0022-3514.88.3.467

Rammstedt, B., & John, O. P. (2007). Measuring personality in one minute or less: A 10-item short version of the Big Five Inventory in English and German. *Journal of Research in Personality, 41*(1), 203-212. doi: 10.1016/j.jrp.2006.02.001

Richeson, J. A., Todd, A. R., Trawalter, S., & Baird, A., A. (2008). Eye-gaze direction modulates race-related aymgdala activity. *Group Processes & Intergroup Relations, 11*(2), 233-246. doi: 10.1177/1368430207088040

Rimmele, U., Hediger, K., Heinrichs, M., & Klaver, P. (2009). Oxytocin makes a face in memory familiar. *The Journal of Neuroscience, 29*(1), 38-42. doi: 10.1523/JNEUROSCI.4260-08.2009

Rowe, R., Maughan, B., Worthman, C. M., Cotstello, E. J., & Angold, A. (2004). Testosterone, antisocial behavior, and social dominance in boys: pubertal development and biosocial interaction. *Biological Psychiatry, 55*(5), 546-552. doi: 10.1016/j.biopsych.2003.10.010

Rushton, J. P. (2005). Ethnic nationalism, evolutionary psychology and Genetic Similarity THeory. *Nations and Nationalism, 11*(4), 489-507. doi: 10.1111/j.1469-8129.2005.00216.x

Schaal, B., Tremblay, R. E., Soussignan, R., & Susman, E. J. (1996). Male testosterone linked to high social dominance but low physical aggression in early adolescence. *Journal of the American Academy of Child & Adolescent Psychiatry, 35*(10), 1322-1330. doi: 10.1097/00004583-199610000-00019

Schütz, H., & Six, B. (1996). How strong is the relationship between prejudice and discrimination? A meta-analytic answer. *International Journal of Intercultural Relations, 20*(3), 441-462. doi: 10.1016/0147-1767(96)00028-4

Sidanius, J., & Pratto, F. (1999). *Social dominance: An intergroup theory of social hierarchy and oppression*. New York: Cambridge University Press.

Sidanius, J., & Pratto, F. (2011). Social dominance theory. In A. W. Kruglanski, E. T. Higgins & P. A. M. Van Lange (Eds.), *Handbook of Theories of Social Psychology: Volume Two* (pp. 418-438): SAGE Publications.

Siiteri, P. K., & Wilson, J. D. (1974). Testosterone formation and metabolism during male sexual differentiation in the human embryo. *The Journal of Clinical Endocrinology & Metabolism, 38*(1), 113-125. doi: 10.1210/jcem-38-1-113

Soloff, M. S., Alexandrova, M., & Fernstrom, M. J. (1979). Oxytocin receptors: Triggers for parturition and lactation? *Science, 204*(4399), 1313-1315. doi: 10.1126/science.221972

Sommers, S. R., & Ellsworth, P. C. (2000). Race in the courtroom: Perceptions of Guilt and Dispositional Attributions. *Personality and Social Psychology Bulletin, 26*(11), 1367-1379. doi: 10.1177/0146167200263005

Sommers, S. R., & Ellsworth, P. C. (2001). White juror bias: An investigation of prejudice against Black defendants in the American courtroom. *Psychology, Public Policy, and Law, 7*(1), 201-229. doi: 10.1037/1076-8971.7.1.201

Stanton, S. J., Beehner, J. C., Saini, E. K., Kuhn, C. M., & LaBar, K. S. (2009). Dominance, politics, and physiology: voters' testosterone changes on the night of the 2008 United States presidential election. *PLoS ONE, 4*(10). doi: 10.1371/journal.pone.0007543

Tajfel, H. (1970). Experiments in intergroup discrimination. *Scientific American, 223*, 96-102.

Tajfel, H., Billig, M. G., Bundy, R. P., & Flament, C. (1971). Social categorization and intergroup behaviour. *European Journal of Social Psychology, 1*(2), 149-178. doi: 10.1002/ejsp.2420010202

Taylor, S. E., Fiske, S. T., Etcoff, N. L., & Ruderman, A. J. (1978). Categorical and contextual bases of person memory and stereotyping. *Journal of Personality and Social Psychology, 36*(7), 778-793. doi: 10.1037/0022-3514.36.7.778

Telzer, E. H., Flannery, J., Shapiro, M., Humphreys, K. L., Goff, B., Gabard-Durman, L., . . . Tottenham, N. (2013). Early experience shapes amygdala sensitivity to race: An international adoption design. *The Journal of Neuroscience, 33*(33), 13484-13488. doi: 10.1523/JNEUROSCI.1272-13.2013

Telzer, E. H., Humphreys, K. L., Shapiro, M., & Tottenham, N. (2013). Amygdala sensitivity to race is not present in childhood but emerges over adolescence. *Journal of Cognitive Neuroscience, 25*(2), 234-244. doi: 10.1162/jocn_a_00311

Tinbergen, N. (1968). On war and peace in animals and man. *Science, 160*(3835), 1411-1418. doi: 10.1126/science.160.3835.1411

Trivers, R. L. (1971). The evolution of reciprocal altruism. *The Quarterly Reivew of Biology, 46*(1), 35-57. doi: 10.2307/2822435

van Bokhoven, I., van Goozen, S. H. M., van Engeland, H., Schaal, B., Arseneault, L., Seguin, J. R., . . . Tremblay, R. E. (2006). Salivary testosterone and aggression, delinquency, and social dominance in a population-based longitudinal study of adolescent males. *Hormones and Behavior, 50*(1), 118-125. doi: 10.1016/j.yhbeh.2006.02.002

van den Berghe, P. L. (1981). *The ethnic phenomenon*. New York, NY, US: Elsevier.

Wagner, J. D., Flinn, M. V., & England, B. G. (2002). Hormonal response to competition among male coalitions. *Evolution and Human Behavior, 23*(6), 437-442. doi: 10.1016/S1090-5138(02)00100-9

Wingfield, J. C., Hegner, R. E., Dufty, A. M. J., & Ball, G., F. (1990). The" challenge hypothesis": Theoretical implications for patterns of testosterone secretion, mating systems, and breeding strategies. *The American Naturalist, 136*(6), 829-846.

Young, L. J., & Wang, Z. (2004). The neurobiology of pair bonding. *Nature Neuroscience, 7*, 1048-1054. doi: 10.1038/nn1327

Zak, P. J., Kurzban, R., Ahmadi, S., Swerdloff, R. S., Park, J., Redwine, K., . . . Matzner, W. (2009). Testosterone administration decreases generosity in the ultimatum game. *PLoS ONE, 4*(12). doi: 10.1371/journal.pone.0008330

Zak, P. J., Stanton, A. A., & Ahmadi, S. (2007). Oxytocin increases generosity in humans. *PLoS ONE, 2*(11). doi: 10.1371/journal.pone.0001128

Table 1: Descriptive statistics and comparisons of the personality traits scores between the experimental conditions.

Trait	M	SD	α	df	*t*	*p*
Fairness			**.76**	**61**	**1.01**	**.317**
Ingroup	5.51	0.93				
Outgroup	5.28	0.86				
Aggressiveness			**.84**	**61**	**-0.37**	**.715**
Ingroup	3.19	0.94				
Outgroup	3.29	1.07				
Cooperativeness			**.69**	**60**	**1.47**	**.147**
Ingroup	4.77	0.66				
Outgroup	4.49	0.86				
Dominance			**.72**	**60**	**0.65**	**.520**
Ingroup	4.25	0.69				
Outgroup	4.13	0.77				
Self-Esteem			**.77**	**59**	**-0.18**	**.858**
Ingroup	5.31	0.67				
Outgroup	5.34	0.87				
Extraversion			**.76**	**60**	**-0.28**	**.778**
Ingroup	4.05	1.82				
Outgroup	4.16	1.27				
Agreeableness			**.25**	**61**	**-0.74**	**.464**
Ingroup	2.92	1.05				
Outgroup	3.11	1.23				
Conscientiousness			**.54**	**61**	**-0.36**	**.717**
Ingroup	5.25	1.05				
Outgroup	5.35	1.23				
Openness			**.35**	**59**	**-0.36**	**.723**
Ingroup	5.47	0.95				
Outgroup	5.55	0.86				
Neuroticism			**.54**	**60**	**0.03**	**.975**
Ingroup	5.09	1.23				
Outgroup	5.08	1.42				

Table 2: Descriptive statistics and comparisons of the post-PSAP responses between the experimental conditions.

Item	M	SD	df	*t*	*p*
I enjoyed playing this game.			**61**	**-0.06**	**.955**
Ingroup	4.69	1.57			
Outgroup	4.71	1.51			
I enjoyed playing with the other player.			**61**	**-1.49**	**.141**
Ingroup	4.66	1.26			
Outgroup	5.13	1.26			
The other player played fairly.			**61**	**-1.56**	**.123**
Ingroup	4.53	2.03			
Outgroup	5.29	1.81			
I would like to play this game in the future.			**61**	**-0.06**	**.954**
Ingroup	3.88	1.86			
Outgroup	3.90	1.99			
I would enjoy playing a team-based task with the other player.			**61**	**-1.63**	**.108**
Ingroup	4.19	1.65			
Outgroup	4.87	1.67			
The other player was familiar to me.			**61**	**-0.96**	**.342**
Ingroup	1.59	1.07			
Outgroup	1.90	1.47			
I earned more points than the other player.			**61**	**0.51**	**.611**
Ingroup	4.56	1.29			
Outgroup	4.39	1.43			
I removed more points from the other player than were stolen from me.			**61**	**1.51**	**.136**
Ingroup	4.03	2.24			
Outgroup	3.23	1.98			

Table 3: Sample items from participants' perceptions of the PSAP and the other "player".

"I tried not to steal anything from him the entire game in hopes that he would stop stealing from me, and I felt like in the third round he stole less from me than the other rounds."
"He seemed like a regular, competitive individual. He wanted to win, even though stealing had no benefit to him, he wanted his point total to be greater than mine."
"Considering the other player was allowed to keep stolen points due to the experiments condition, it is hard to find fault with them taking advantage."
"I learned his way of behaviour in the first 2 rounds and that allowed me to gather more points in the third round than in previous two, without hitting the key #2. He was quite prone to steal points from me, but I believe I was able to somewhat deter him from doing so."
"I suppose that the other player wasn't as aggressive in removing my points as I was in removing his points. I'm sure it was all for good reasoning though."
"the other player was playing the game normally, they didn't retaliate directly when I stole points from them, even though I did when they stole points from me"
"he stole too many points from me. i didn't even attack his points until he stole repeatedly from me. the other player wanted to win by bringing someone else down."

Table 4: Bivariate correlations between testosterone residuals and aggression residuals for all participants.

	Post-PSAP Testosterone (residual)	Aggression Round 1 (residual)	Aggression Round 2 (residual)	Aggression Round 3 (residual)	Aggregate Aggression (residual)
Post-PSAP Testosterone (residual)	1.00				
Aggression Round 1 (residual)	.05[a]	1.00			
Aggression Round 2 (residual)	.05[a]	.78[b**]	1.00		
Aggression Round 3 (residual)	.23[a]	.58[b**]	.72[b**]	1.00	
Aggregate Aggression (residual)	.14[a]	.88[b**]	.93[b**]	.85[b**]	1.00

Note. a: n = 60, b: n = 63
*p < .05, **p < .01

Table 5: Bivariate correlations between testosterone residuals and aggression residuals separated by experimental condition (i.e. “ingroup” & “outgroup”).

	Post-PSAP Testosterone (residual)	Aggression Round 1 (residual)	Aggression Round 2 (residual)	Aggression Round 3 (residual)	Aggregate Aggression (residual)
Post-PSAP Testosterone (residual)	1.00	.02[a]	.-04[a]	.11[a]	.06[a]
Aggression Round 1 (residual)	11.[C]	1.00	.84[b**]	.68[b**]	.93[b**]
Aggression Round 2 (residual)	42.[C*]	63.[C**]	1.00	.75[b**]	.95[b**]
Aggression Round 3 (residual)	39.[C*]	49.[c**]	82.[c**]	1.00	.86[b**]
Aggregate Aggression (residual)	36.[c*]	77.[c**]	.93[c**]	90.[c**]	1.00

Note. Correlations for the “ingroup” condition are found on the top diagonal while the correlations for the “outgroup” condition are found on the bottom diagonal.
a: n = 29, b: n = 32; c: n = 31
*p < .05, **p < .01

Figure 1: Facial photographs used as stimuli for the second player in the PSAP.

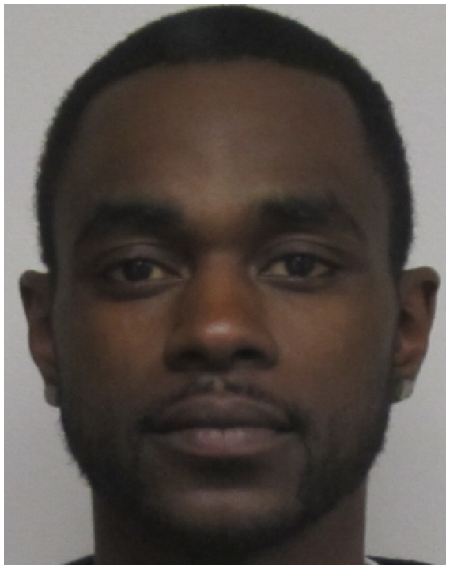


Figure 2: Experimental timeline.

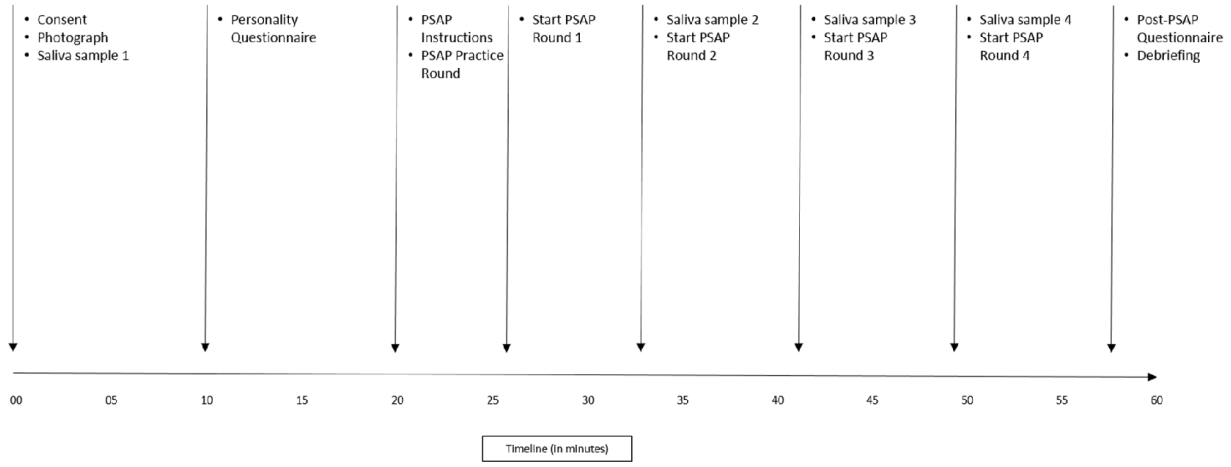


Figure 3: Aggression residuals across the three PSAP rounds by experimental condition.

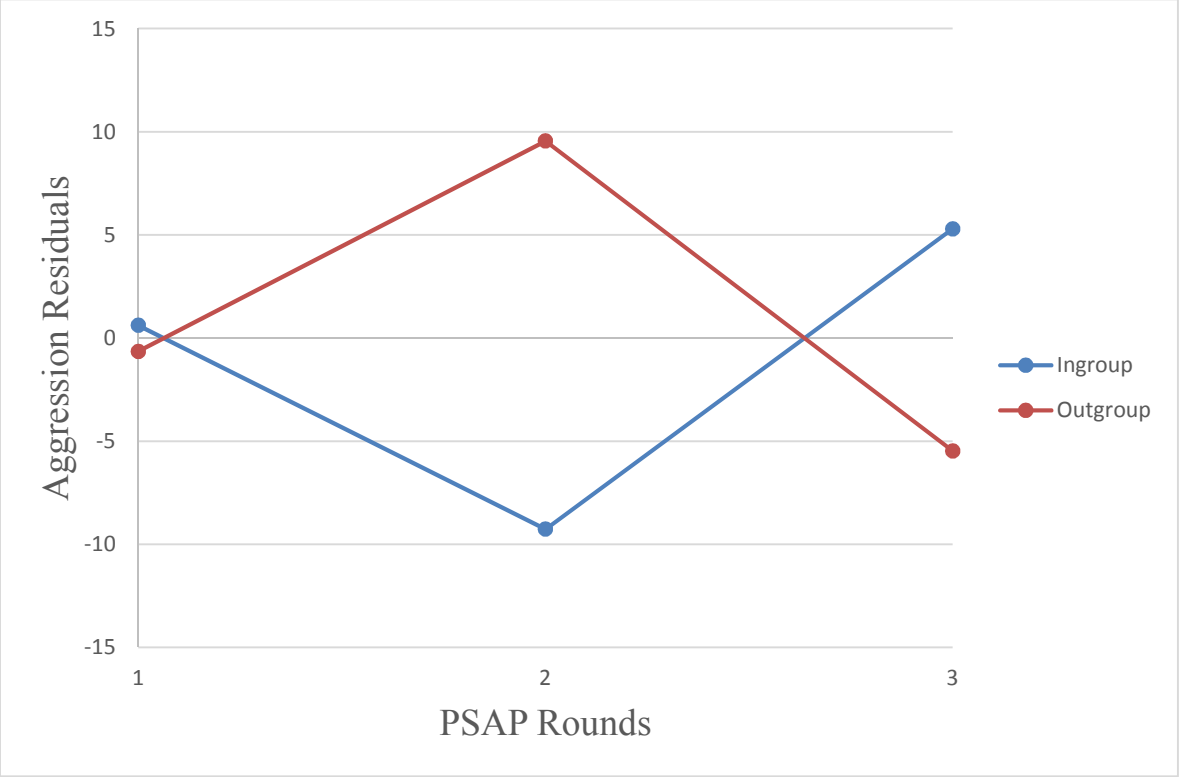


Figure 4: Raw values of testosterone across the four time points by experimental condition.

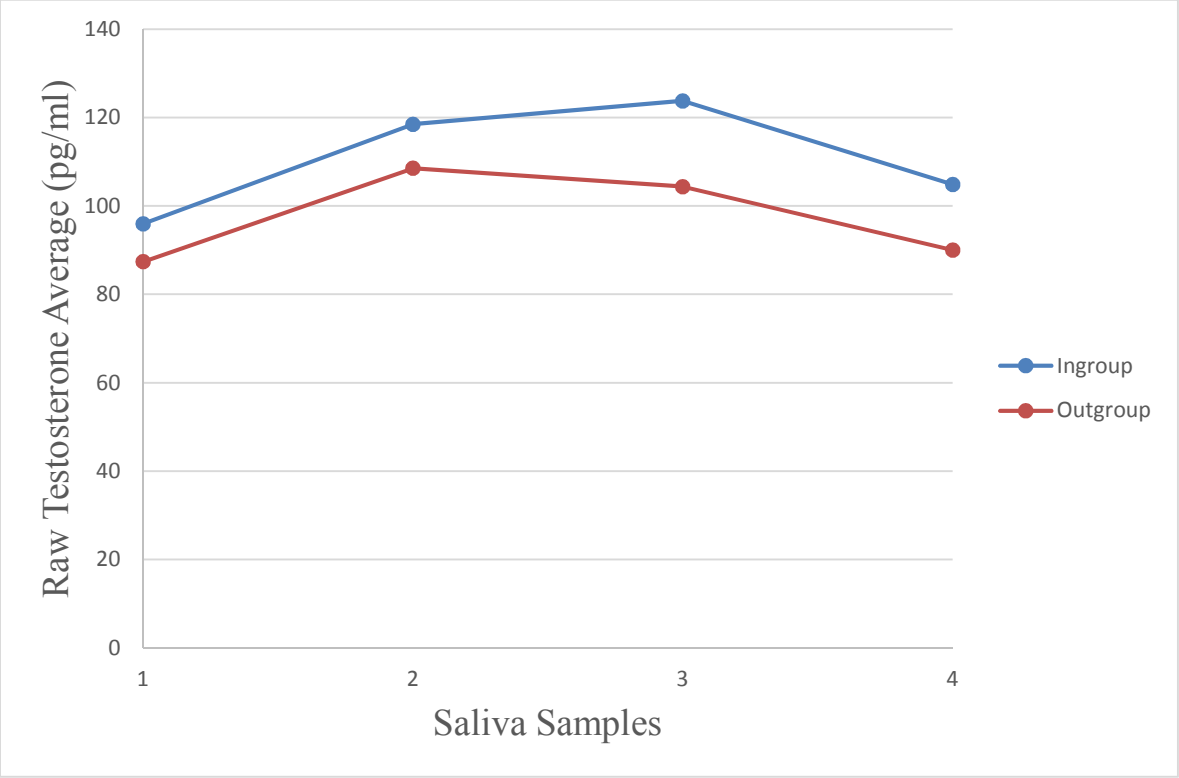


Figure 5: Moderation effect of group status on the relationship between testosterone change and aggression in the first round of the PSAP.

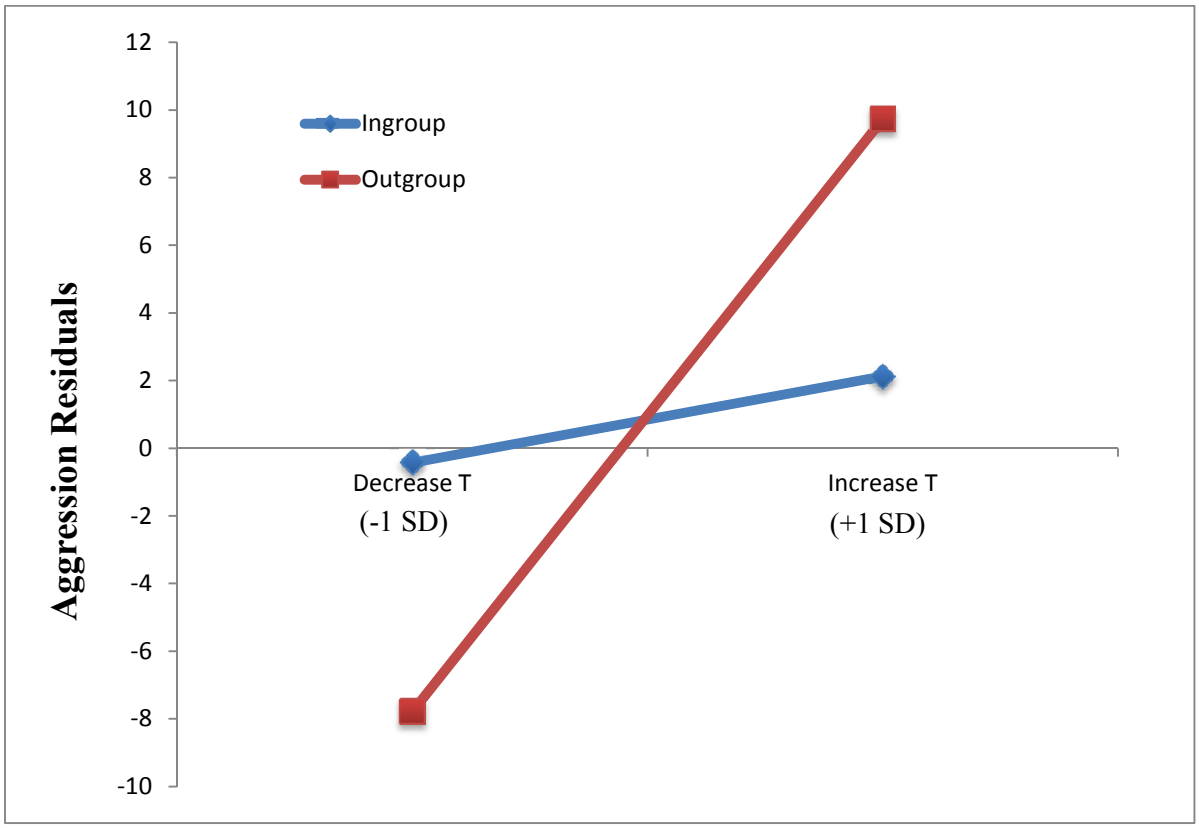


Figure 6: Moderation effect of group status on the relationship between testosterone change and aggression in the second round of the PSAP.

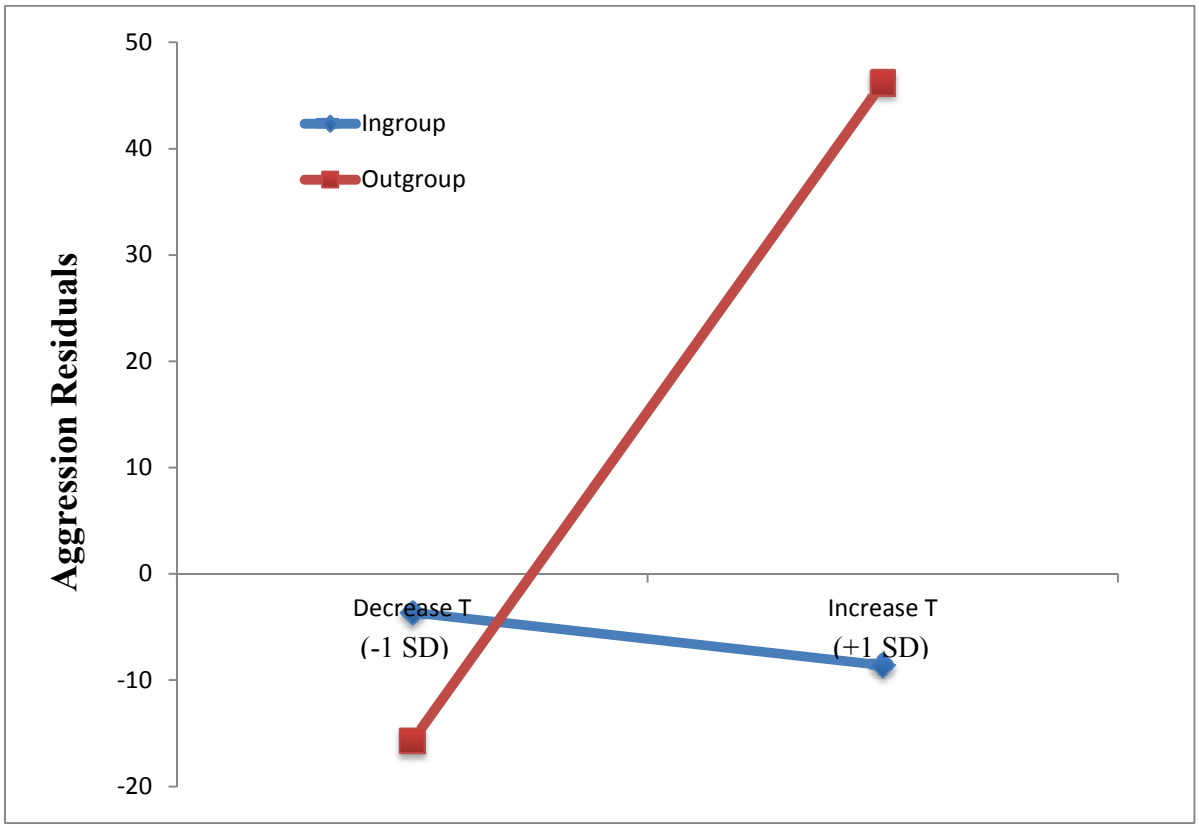


Figure 7: Moderation effect of group status on the relationship between testosterone change and aggression in the third round of the PSAP.

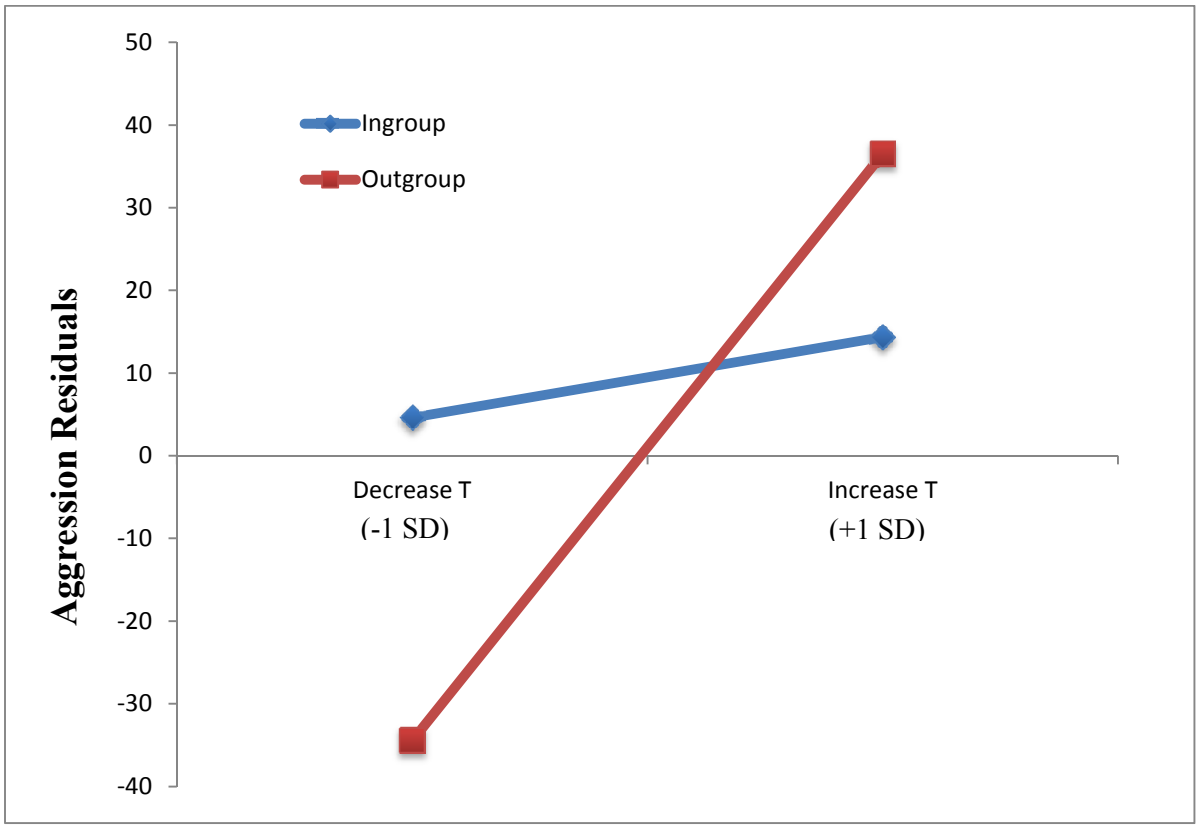
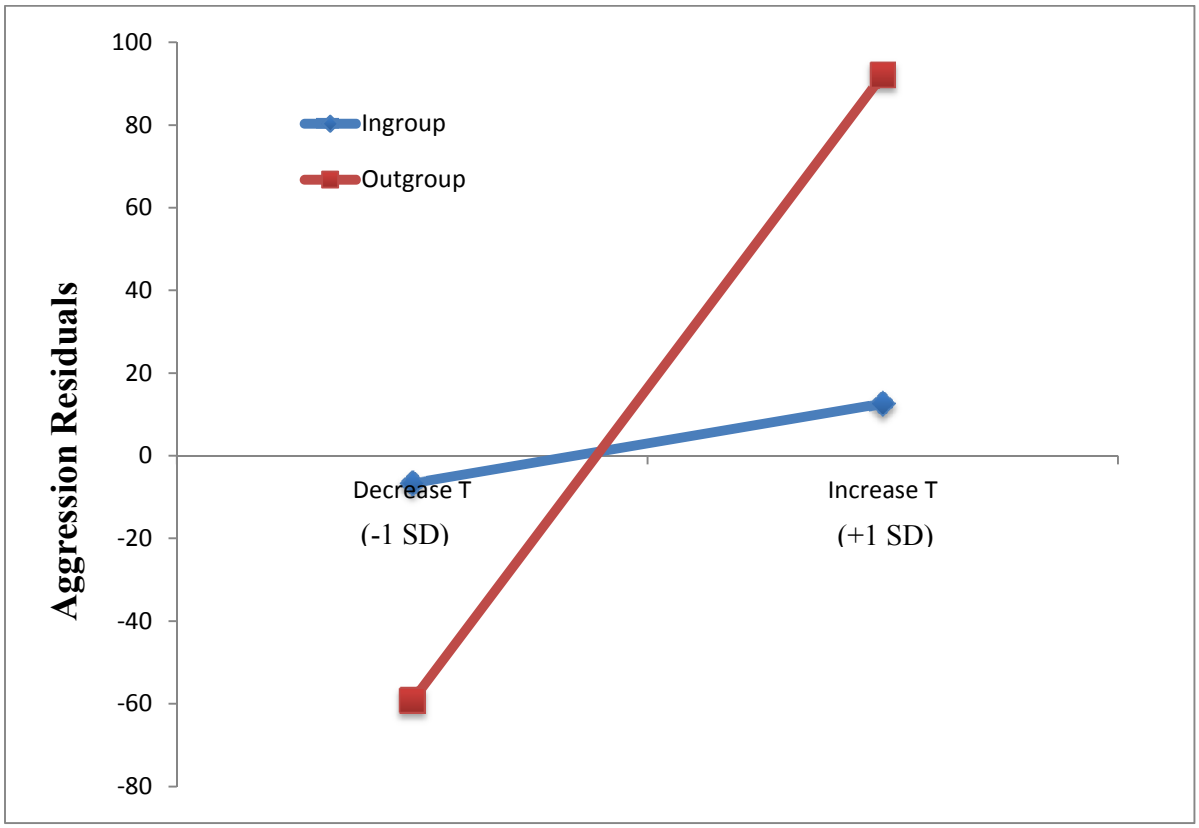


Figure 8: Moderation effect of group status on the relationship between testosterone change and aggression across the three PSAP rounds.



ABSTRACT

FRIEND OR FOE: THE EFFECT OF SHARED GROUP STATUS ON AGGRESSIVENESS AND TESTOSTERONE IN RESPONSE TO PROVOCATION

by

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December 2014

Advisor: Dr. Justin Carré

Major: PSYCHOLOGY (Cognitive, Developmental, and Social Psychology)

Degree: Doctor of Philosophy

Previous research has found that individuals display behavioral and hormonal differences when engaged in competition with natural and experimental ingroup and outgroup members. The current work expands on this line of research by examining the impact of shared group status on reactive aggression in response to provocation. Using a previously validated measure of reactive aggression, participants were provoked by and given a chance to aggress on to either a racial ingroup or outgroup member. Participants also provided saliva samples to allow for monitoring changes in testosterone. It was hypothesized that behavioral aggression would be predicted by changes in testosterone and that this relationship would be moderated by group status. Analyses indicated that the relationship between aggression and changes in testosterone, a previously established relationship, was present primarily for participants playing with an outgroup member, while the relationship was not present for those playing with an ingroup member. The results and future directions are discussed in relation to previous aggression studies with respect to the current study's experimental manipulation and behavioral measurement.

AUTOBIOGRAPHICAL STATEMENT

Eric W. Fuller

Eric finished his undergraduate education with a B. A. in psychology from the University of Michigan – Dearborn of 2007 and was admitted into Wayne State's graduate program for psychology under the supervision of Dr. Rusty McIntyre. In Dr. McIntyre's social cognition lab, Eric's primary research interests revolved around the perceptions and implications of stereotypes and prejudice. During his time at Wayne State, Eric has also worked at the University of Michigan – Dearborn as an adjunct faculty member since 2009, where he has taught multiple courses in social psychology, statistics, and experimental design. Following the departure of Dr. McIntyre from Wayne State, Eric joined the lab of Dr. Justin Carré. Under the guidance of Dr. Carré, Eric designed and conducted his dissertation research. Eric plans to move on from Wayne State and pursue a position with a focus teaching at the undergraduate level and a continuation of his work on the psychology of prejudice.